

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\bar{d}, (u\bar{u}-d\bar{d})/\sqrt{2}, d\bar{u};$
 for $I = 0$ ($\eta, \eta', h, h', \omega, \phi, f, f'$): $c_1(u\bar{u} + d\bar{d}) + c_2(s\bar{s})$

NODE=MXXX005

NODE=MXXX005

NODE=M014

$f_0(500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

also known as σ ; was $f_0(600)$, $f_0(400-1200)$
 See the related review(s):

Scalar Mesons below 1 GeV

$f_0(500)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M014PP

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→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE (see Fig. 64.3 in the review)			
$(458 \pm 7^{+4}_{-10}) - i(245 \pm 6^{+7}_{-10})$	¹ DANILKIN	21	RVUE Compilation
$(410 \pm 20) - i(240 \pm 15)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(512 \pm 15) - i(188 \pm 12)$	² ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma 3\pi$
$(440 \pm 10) - i(238 \pm 10)$	³ ALBALADEJO	12	RVUE Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	^{4,5} GARCIA-MAR..11	RVUE	Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	^{4,6} GARCIA-MAR..11	RVUE	Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	⁷ MOUSSALLAM11	RVUE	Compilation
$(452 \pm 13) - i(259 \pm 16)$	⁸ MENNESSIER	10	RVUE Compilation
$(448 \pm 43) - i(266 \pm 43)$	⁹ MENNESSIER	10	RVUE Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	¹⁰ CAPRINI	08	RVUE Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	¹¹ CAPRINI	08	RVUE Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	¹² ABLIKIM	07A	BES2 $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	¹³ BONVICINI	07	CLEO $D^+ \rightarrow \pi^-\pi^+\pi^+$
$(472 \pm 30) - i(271 \pm 30)$	¹⁴ BUGG	07A	RVUE Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..07	RVUE	Compilation
$(430) - i(325)$	¹⁵ ANISOVICH	06	RVUE Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	¹⁶ CAPRINI	06	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	¹⁷ ZHOU	05	RVUE
$(541 \pm 39) - i(252 \pm 42)$	¹⁸ ABLIKIM	04A	BES2 $J/\psi \rightarrow \omega\pi^+\pi^-$
$(528 \pm 32) - i(207 \pm 23)$	¹⁹ GALLEGOS	04	RVUE Compilation
$(533 \pm 25) - i(249 \pm 25)$	²⁰ BUGG	03	RVUE
$517 - i240$	BLACK	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 30) - i(295 \pm 20)$	¹⁶ COLANGELO	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(535^{+48}_{-36}) - i(155^{+76}_{-53})$	²¹ ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
$610 \pm 14 - i(310 \pm 13)$	²² SUROVTSEV	01	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$(540^{+36}_{-29}) - i(193^{+32}_{-40})$	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0\pi^0\pi^0$
$445 - i235$	HANNAH	99	RVUE π scalar form factor
$(523 \pm 12) - i(259 \pm 7)$	KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$442 - i227$	OLLER	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$469 - i203$	OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$445 - i221$	OLLER	99C	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
$420 - i212$	LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$440 - i245$	²³ DOBADO	97	RVUE Compilation
$(602 \pm 26) - i(196 \pm 27)$	²⁴ ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
$(537 \pm 20) - i(250 \pm 17)$	²⁵ KAMINSKI	97B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
$470 - i250$	^{26,27} TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
$387 - i305$	^{27,28} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$420 - i370$	²⁹ ACHASOV	94	RVUE $\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$370 - i356$	³⁰ ZOU	94B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

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408 — $i342$	27,30 ZOU 93	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
470 — $i208$	31 VANBEVEREN 86	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$
(750 ± 50) — $i(450 \pm 50)$	32 ESTABROOKS 79	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
(660 ± 100) — $i(320 \pm 70)$	PROTOPOP... 73	HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$
650 — $i370$	33 BASDEVANT 72	RVUE $\pi\pi \rightarrow \pi\pi$
1	Data driven analysis using partial-wave dispersion relations .	
2	S-matrix pole; 8595 events.	
3	Applying the chiral unitary approach at NLO to the K_{e4} data of BATLEY 10 and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.	
4	Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73.	
5	Analytic continuation using Roy equations.	
6	Analytic continuation using GKPY equations.	
7	Using Roy equations.	
8	Average of three variants of the analytic K-matrix model. Uses the K_{e4} data of BATLEY 08A and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73 and GRAYER 74.	
9	Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73, and GRAYER 74, partially of COHEN 80 or ETKIN 82B.	
10	From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.	
11	From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPESCU 73, GRAYER 74, and ESTABROOKS 74.	
12	From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.	
13	From an isobar model using 2.6k events.	
14	Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.	
15	Using the N/D method.	
16	From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.	
17	Reanalysis of the data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.	
18	From a mean of six different analyses and $f_0(500)$ parameterizations.	
19	Using data on $\psi(2S) \rightarrow J/\psi\pi\pi$ from BAI 00E and on $\Upsilon(nS) \rightarrow \Upsilon(mS)\pi\pi$ from BUTLER 94B and ALEXANDER 98.	
20	From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.	
21	A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.	
22	Coupled channel reanalysis of BATON 70, BENSINGER 71, BAILLON 72, HYAMS 73, HYAMS 75, ROSSELET 77, COHEN 80, and ETKIN 82B using the uniformizing variable.	
23	Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPESCU 73.	
24	Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.	
25	Average and spread of 4 variants ("up" and "down") of KAMINSKI 97B 3-channel model.	
26	Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.	
27	Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.	
28	Analysis of data from FALVARD 88.	
29	Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.	
30	Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.	
31	Coupled-channel analysis using data from PROTOPOPESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEN 79, BISWAS 81.	
32	Analysis of data from APEL 72C, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.	
33	Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPESCU 73, and WALKER 67.	

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$f_0(500)$ BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

400 to 800 OUR ESTIMATE

• • • We do not use the following data for averages, fits, limits, etc. • • •

513 ± 32	34 MURAMATSU 02	CLEO	$e^+e^- \approx 10$ GeV
478 $^{+24}_{-23}$ ± 17	AITALA 01B	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563 $^{+58}_{-29}$	35 ISHIDA 01		$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
555	36 ASNER 00	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
540 ± 36	ISHIDA 00B		$p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$
750 ± 4	ALEKSEEV 99	SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
744 ± 5	ALEKSEEV 98	SPEC	1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$

NODE=M014M

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759± 5	37 TROYAN	98	5.2 $np \rightarrow np\pi^+\pi^-$
780±30	ALDE	97	GAM2 450 $pp \rightarrow pp\pi^0\pi^0$
585±20	38 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
761±12	39 SVEC	96	RVUE 6–17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 860	40,41 TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165±50	42,43 ANISOVICH	95	RVUE $\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
414±20	39 AUGUSTIN	89	DM2

34 Statistical uncertainty only.

35 A similar analysis (KOMADA 01) finds 526^{+48}_{-37} MeV.

36 From the best fit of the Dalitz plot.

37 6σ effect, no PWA.

38 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.

39 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^-\pi^+N$ on polarized targets. The fit does not include $f_0(980)$.

40 Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

41 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$ decays.

42 Uses $\pi^0\pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+\pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.

43 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

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NODE=M014M;LINKAGE=KK

NODE=M014M;LINKAGE=TN

NODE=M014M;LINKAGE=AA

NODE=M014M;LINKAGE=E

NODE=M014M;LINKAGE=B

NODE=M014M;LINKAGE=GG

NODE=M014M;LINKAGE=F

NODE=M014M;LINKAGE=G

$f_0(500)$ BREIT-WIGNER WIDTH

NODE=M014W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
100 to 800 OUR ESTIMATE			

• • • We do not use the following data for averages, fits, limits, etc. • • •

335± 67	44 MURAMATSU	02	CLEO $e^+e^- \approx 10$ GeV
324 $^{+42}_{-40} \pm 21$	AITALA	01B	E791 $D^+ \rightarrow \pi^-\pi^+\pi^+$
372 $^{+229}_{-95}$	45 ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon\pi\pi$
540	46 ASNER	00	CLE2 $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$
372± 80	ISHIDA	00B	$p\bar{p} \rightarrow \pi^0\pi^0\pi^0$
119± 13	ALEKSEEV	99	SPEC 1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^-\pi^+n$
77± 22	ALEKSEEV	98	SPEC 1.78 $\pi^- p_{\text{polar}} \rightarrow \pi^-\pi^+n$
35± 12	47 TROYAN	98	5.2 $np \rightarrow np\pi^+\pi^-$
780± 60	ALDE	97	GAM2 450 $pp \rightarrow pp\pi^0\pi^0$
385± 70	48 ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
290± 54	49 SVEC	96	RVUE 6–17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 880	50,51 TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
460± 40	52,53 ANISOVICH	95	RVUE $\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
494± 58	49 AUGUSTIN	89	DM2

44 Statistical uncertainty only.

45 A similar analysis (KOMADA 01) finds 301^{+145}_{-100} MeV.

46 From the best fit of the Dalitz plot.

47 6σ effect, no PWA.

48 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.

49 Breit-Wigner fit to S-wave intensity measured in $\pi N \rightarrow \pi^-\pi^+N$ on polarized targets. The fit does not include $f_0(980)$.

50 Uses data from ASTON 88, OCHS 73, HYAMS 73, ARMSTRONG 91B, GRAYER 74, CASON 83, ROSSELET 77, and BEIER 72B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

51 Also observed by ASNER 00 in $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$ decays.

52 Uses $\pi^0\pi^0$ data from ANISOVICH 94, AMSLER 94D, and ALDE 95B, $\pi^+\pi^-$ data from OCHS 73, GRAYER 74 and ROSSELET 77, and $\eta\eta$ data from ANISOVICH 94.

53 The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

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NODE=M014W;LINKAGE=KK

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NODE=M014W;LINKAGE=B

NODE=M014W;LINKAGE=GG

NODE=M014W;LINKAGE=F

NODE=M014W;LINKAGE=G

NODE=M014W
→ UNCHECKED ←

$f_0(500)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad \gamma\gamma$	seen

NODE=M014215;NODE=M014

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

 $f_0(500)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$	Γ_2
VALUE (keV)	DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.37 ± 13	+0.09 -0.06	54	DANILKIN	21	RVUE	Compilation
2.05 ± 0.21		55	DAI	14A	RVUE	Compilation
1.7 ± 0.4		56	HOFRICHT...	11	RVUE	Compilation
3.08 ± 0.82		57	MENNESSIER	11	RVUE	Compilation
2.08 ± 0.2	+0.07 -0.04	58	MOUSSALLAM	11	RVUE	Compilation
2.08		59	MAO	09	RVUE	Compilation
1.2 ± 0.4		60	BERNABEU	08	RVUE	
3.9 ± 0.6		57	MENNESSIER	08	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
1.8 ± 0.4		61	OLLER	08	RVUE	Compilation
1.68 ± 0.15		61,62	OLLER	08A	RVUE	Compilation
3.1 ± 0.5		63,64	PENNINGTON	08	RVUE	Compilation
2.4 ± 0.4		64,65	PENNINGTON	08	RVUE	Compilation
4.1 ± 0.3		66	PENNINGTON	06	RVUE	$\gamma\gamma \rightarrow \pi^0\pi^0$
3.8 ± 1.5		67,68	BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
5.4 ± 2.3		67	MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
10 ± 6			COURAU	86	DM1	$e^+e^- \rightarrow \pi^+\pi^- e^+e^-$

54 Using the value of the coupled channel analysis.

55 Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

56 Using Roy-Steiner equations with $\pi\pi$ phase shifts from an update of COLANGELO 01 and from GARCIA-MARTIN 11A.

57 Using an analytic K-matrix model.

58 Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

59 Used dispersion theory. The value quoted used the $f_0(500)$ pole position of $457 - i276$ MeV.60 Using p, n polarizabilities from PDG 06 and fitting to $\pi\pi$ phase motion from GARCIA-MARTIN 07 and σ -poles from GARCIA-MARTIN 07 and CAPRINI 06.

61 Using twice-subtracted dispersion integrals.

62 Supersedes OLLER 08.

63 Solution A (preferred solution based on χ^2 -analysis).

64 Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

65 Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

66 Using unitarity and the σ pole position from CAPRINI 06.67 This width could equally well be assigned to the $f_0(1370)$. The authors analyse data from BOYER 90 and MARSISKE 90 and report strong correlation with $\gamma\gamma$ width of $f_2(1270)$.

68 Supersedes MORGAN 90.

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NODE=M014W2

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NODE=M014W2;LINKAGE=B

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NODE=M014W2;LINKAGE=A

NODE=M014W2;LINKAGE=BL

 $f_0(500)$ REFERENCES

DANILKIN	21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen (MAINZ)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i> (BONN, PNPI)
ABLIKIM	17	PRL 118 012001	M. Ablikim <i>et al.</i> (BESIII Collab.)
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington (CEBAF)
ALBALADEJO	12	PR D86 034003	M. Albaladejo, J.A. Oller (MURC)
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i> (MADR, CRAC)
HOFRICHT...	11	EPJ C71 1743	M. Hoferichter, D.R. Phillips, C. Schat (BONN+)
MENNESSIER	11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang
MOUSSALLAM	11	EPJ C71 1814	B. Moussallam
BATLEY	10	PL B686 101	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
MENNESSIER	10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang
MAO	09	PR D79 116008	Y. Mao <i>et al.</i>
BATLEY	08A	EPJ C54 411	J.R. Batley <i>et al.</i> (CERN NA48/2 Collab.)
BERNABEU	08	PRL 100 241804	J. Bernabeu, J. Prades (IFIC, GRAN)
CAPRINI	08	PR D77 114019	I. Caprini
MENNESSIER	08	PL B665 205	G. Mennessier, S. Narison, W. Ochs
OLLER	08	PL B659 201	J.A. Oller, L. Roca, C. Schat (MURC, UBA)
OLLER	08A	EPJ A37 15	J.A. Oller, L. Roca (MURC)
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>

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REFID=52271

REFID=52273

REFID=52299

REFID=53976

REFID=53977

REFID=52303

UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
ABLIKIM	07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51614
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>		REFID=53252
GARCIA-MAR...	07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain		REFID=51949
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ANISOVICH	06	IJMP A21 3615	V.V. Anisovich		REFID=51137
CAPRINI	06	PRL 96 132001	I. Caprini, G. Colangelo, H. Leutwyler	(BCIP+)	REFID=51076
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
PENNINGTON	06	PRL 97 011601	M.R. Pennington		REFID=51184
ZHOU	05	JHEP 0502 043	Z.Y. Zhou <i>et al.</i>		REFID=50823
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
BUETTAKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam		REFID=56428; ERROR=1
GALLEGOS	04	PR D69 074033	A. Gallegos <i>et al.</i>		REFID=49769
BUGG	03	PL B572 1	D.V. Bugg		REFID=49586
PISLAK	03	PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PR D81 119903E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53337
MURAMATSU	02	PRL 89 251802	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49081
Also		PRL 90 059901 (errat.)	H. Muramatsu <i>et al.</i>	(CLEO Collab.)	REFID=49385
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
BLACK	01	PR D64 014031	D. Black <i>et al.</i>		REFID=48314
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leutwyler		REFID=49180
ISHIDA	01	PL B518 47	M. Ishida <i>et al.</i>		REFID=48354
KOMADA	01	PL B508 31	T. Komada <i>et al.</i>		REFID=48541
PISLAK	01	PRL 87 221801	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=48433
Also		PR D67 072004	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=49344
Also		PRL 105 019901E	S. Pislak <i>et al.</i>	(BNL E865 Collab.)	REFID=53338
SUROVTSEV	01	PR D63 054024	Y.S. Surovtsev, D. Krupa, M. Nagy		REFID=48310
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=47339
BAI	00E	PR D62 032002	J. Bai <i>et al.</i>	(BES Collab.)	REFID=47955
ISHIDA	00B	PTP 104 203	M. Ishida <i>et al.</i>		REFID=48358
ALEKSEEV	99	NP B541 3	I.G. Alekseev <i>et al.</i>		REFID=46614
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
HANNAH	99	PR D60 017502	T. Hannah		REFID=46935
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (errat.)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (errat.)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ALEKSEEV	98	PAN 61 174	I.G. Alekseev <i>et al.</i>		REFID=46328
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
LOCHER	98	EPJ C4 317	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	JINRRC 5-91 33	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PR D56 3057	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PTP 98 1005	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45998
KAMINSKI	97B	PL B413 130	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, IPN)	REFID=45778
Also		PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
SVEC	96	PR D53 2343	M. Svec	(MCGI)	REFID=44509
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELSE)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
ACHASOV	94	PR D49 5779	N.N. Achasov, G.N. Shestakov	(NOVM)	REFID=44087
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43659
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43799
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet	(CRAC+)	REFID=45771
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
ZOU	93	PR D48 3948	B.S. Zou, D.V. Bugg	(LOQM)	REFID=43672
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
COURAU	86	NP B271 1	A. Courau <i>et al.</i>	(CLER, LALO)	REFID=44510
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>	(NIJM, BIEL)	REFID=45769
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BISWAS	81	PRL 47 1378	N.N. Biswas <i>et al.</i>	(NDAM, ANL)	REFID=21106
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
MUKHIN	80	JETPL 32 601	K.N. Mukhin <i>et al.</i>	(KIAE)	REFID=44528
Translated from		ZETFP 32 616			
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	PR D19 2678	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	PR D12 681	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
ESTABROOKS	73	Tallahassee	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
APEL	72C	PL 41B 542	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=21013
BAILLON	72	PL 38B 555	P.H. Baillon <i>et al.</i>	(SLAC)	REFID=20093
BASDEVANT	72	PL 41B 178	J.L. Basdevant, C.D. Froggatt, J.L. Petersen	(CERN)	REFID=20095
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i>	(PENN)	REFID=44530
BENSINGER	71	PL 36B 134	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=21006
COLTON	71	PR D3 2028	E.P. Colton <i>et al.</i>	(LBL, FNAL, UCLA+)	REFID=44533
ROY	71	PL 36B 353	S.M. Roy		REFID=51107
BATON	70	PL 33B 528	J.P. Baton, G. Laurens, J. Reigner	(SACL)	REFID=20086
WALKER	67	RMP 39 695	W.D. Walker	(WISC)	REFID=20960

$\rho(770)$

$$I^G(J^{PC}) = 1^+(1^--)$$

 $\rho(770)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(761-765) – i (71-74) OUR ESTIMATE			
$(763.7^{+1.7}_{-1.5}) - i(73.2^{+1.0}_{-1.1})$	¹ GARCIA-MAR..11	RVUE	Compilation
$(754 \pm 18) - i(74 \pm 10)$	² PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$
$(762.4 \pm 1.8) - i(72.6 \pm 1.4)$	COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$

¹ Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOESCU 73 using GKPY equations.

² Reanalysis of data from PROTOPOESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.

 $\rho(770)$ MASS

We no longer list S -wave Breit-Wigner fits, or data with high combinatorial background.

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26$\pm$0.23 OUR AVERAGE				
775.3 $\pm$ 0.5 $\pm$ 0.6		¹ ACHASOV 21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
775.02 $\pm$ 0.35		² LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
775.97 $\pm$ 0.46 $\pm$ 0.70	900k	³ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
774.6 $\pm$ 0.4 $\pm$ 0.5	800k	^{4,5} ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
775.65 $\pm$ 0.64 $\pm$ 0.50	114k	^{6,7} AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
775.9 $\pm$ 0.5 $\pm$ 0.5	1.98M	⁸ ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.8 $\pm$ 0.9 $\pm$ 2.0	500k	⁸ ACHASOV 02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 $\pm$ 1.1		⁹ BARKOV 85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
763.49 $\pm$ 0.53		¹⁰ BARTOS 17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
758.23 $\pm$ 0.46		¹¹ BARTOS 17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
775.8 $\pm$ 0.5 $\pm$ 0.3	1.98M	¹² ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 $\pm$ 0.6 $\pm$ 0.5	1.98M	¹³ ALOISIO 03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.0 $\pm$ 0.6 $\pm$ 1.1	500k	¹⁴ ACHASOV 02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 $\pm$ 0.7 $\pm$ 5.3		¹⁵ BENAYOUN 98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-,$ $\mu^+\mu^-$
770.5 $\pm$ 1.9 $\pm$ 5.1		¹⁶ GARDNER 98	RVUE	$0.28-0.92 e^+e^- \rightarrow$ $\pi^+\pi^-$
764.1 $\pm$ 0.7		¹⁷ O'CONNELL 97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
757.5 $\pm$ 1.5		¹⁸ BERNICHA 94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
768 $\pm$ 1		¹⁹ GESHKEN... 89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.

² Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

³ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

⁴ Supersedes ACHASOV 05A.

⁵ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

⁶ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

⁷ Update of AKHMETSHIN 02.

⁸ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁹ From the GOUNARIS 68 parametrization of the pion form factor.

¹⁰ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

¹¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

¹² Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.

¹³ Without limitations on masses and widths.

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NODE=M009PP

NODE=M009PP

NODE=M009PP

→ UNCHECKED ←

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OCCUR=2

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NODE=M009PP;LINKAGE=B

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NODE=M009205

NODE=M009M0

NODE=M009M0

OCCUR=2

OCCUR=3

OCCUR=3

NODE=M009M0;LINKAGE=D

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NODE=M009M0;LINKAGE=AK

NODE=M009M0;LINKAGE=AC

NODE=M009M0;LINKAGE=SN

NODE=M009M0;LINKAGE=GS

NODE=M009M0;LINKAGE=PT

NODE=M009M0;LINKAGE=CH

NODE=M009M0;LINKAGE=K

NODE=M009M0;LINKAGE=A

NODE=M009M0;LINKAGE=B

NODE=M009M0;LINKAGE=DF

NODE=M009M0;LINKAGE=WO

- ¹⁴ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.
¹⁵ Using the data of BARKOV 85 in the hidden local symmetry model.
¹⁶ From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.
¹⁷ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.
¹⁸ Applying the S-matrix formalism to the BARKOV 85 data.
¹⁹ Includes BARKOV 85 data. Model-dependent width definition.

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 NODE=M009M0;LINKAGE=K2
 NODE=M009M0;LINKAGE=G8
 NODE=M009M0;LINKAGE=AB
 NODE=M009M0;LINKAGE=AA
 NODE=M009M0;LINKAGE=F

CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
775.11±0.34 OUR AVERAGE					
774.6 ±0.2 ±0.5	5.4M	^{1,2} FUJIKAWA	08	BELL ±	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 ±0.7		^{2,3} SCHAELE	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 ±0.5 ±0.4	1.98M	⁴ ALOISIO	03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ±1.1 ±0.5	87k	^{5,6} ANDERSON	00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
761.60±0.95		⁷ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.8 ±0.6 ±0.4	1.98M	⁸ ALOISIO	03	KLOE −	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
776.3 ±0.6 ±0.7	1.98M	⁸ ALOISIO	03	KLOE +	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
773.9 ±2.0 ^{+0.3} _{−1.0}		⁹ SANZ-CILLERO	03	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.5 ±0.7 ±1.5	500k	⁴ ACHASOV	02	SND ±	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ±0.5		¹⁰ PICH	01	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

NODE=M009M5
 NODE=M009M5

- ¹ $|F_\pi(0)|^2$ fixed to 1.
² From the GOUNARIS 68 parametrization of the pion form factor.
³ The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.
⁴ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
⁵ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.
⁶ From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.
⁷ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of FUJIKAWA 08.
⁸ Without limitations on masses and widths.
⁹ Using the data of BARATE 97M and the effective chiral Lagrangian.
¹⁰ From a fit of the model-independent parameterization of the pion form factor to the data of BARATE 97M.

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OCCUR=3

OCCUR=2

NODE=M009M5;LINKAGE=FU
 NODE=M009M5;LINKAGE=GO
 NODE=M009M5;LINKAGE=SC

NODE=M009M5;LINKAGE=CH
 NODE=M009M5;LINKAGE=A6
 NODE=M009M5;LINKAGE=K1

NODE=M009M5;LINKAGE=A

NODE=M009M5;LINKAGE=WO
 NODE=M009M5;LINKAGE=Z
 NODE=M009M5;LINKAGE=PC

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
763.0±0.3±1.2	600k	¹ ABELE	99E	CBAR 0±	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

- ¹ Assuming the equality of ρ^+ and ρ^- masses and widths.

NODE=M009M7
 NODE=M009M7

NODE=M009M7;LINKAGE=LB

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
766.5±1.1 OUR AVERAGE					
763.7±3.2		ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
768 ±9		AGUILAR-...	91	EHS	400 $p\bar{p}$
767 ±3	2935	¹ CAPRARO	87	SPEC −	$200 \pi^- \text{Cu} \rightarrow \pi^-\pi^0\text{Cu}$
761 ±5	967	¹ CAPRARO	87	SPEC −	$200 \pi^- \text{Pb} \rightarrow \pi^-\pi^0\text{Pb}$
771 ±4		HUSTON	86	SPEC +	$202 \pi^+ \text{A} \rightarrow \pi^+\pi^0\text{A}$
766 ±7	6500	² BYERLY	73	OSPK −	$5 \pi^- p$
766.8±1.5	9650	³ PISUT	68	RVUE −	$1.7-3.2 \pi^- p, t < 10$
767 ±6	900	¹ EISNER	67	HBC −	$4.2 \pi^- p, t < 10$

- ¹ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
² Phase shift analysis. Systematic errors added corresponding to spread of different fits.
³ From fit of 3-parameter relativistic P -wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.

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 NODE=M009M2

OCCUR=2

NODE=M009M2;LINKAGE=Z
 NODE=M009M2;LINKAGE=X
 NODE=M009M2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
769.2± 0.9 OUR AVERAGE				
770.8± 1.3 ^{+2.3} _{-2.4}	900k	ANDREEV 20	H1	$ep \rightarrow e\pi^+\pi^-p$
771 ± 2 ⁺² ₋₁	63.5k	¹ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
770 ± 2 ± 1	79k	² BREITWEG 98B	ZEUS	50–100 γp
767.6± 2.7		BARTALUCCI 78	CNTR	$\gamma p \rightarrow e^+e^-p$
775 ± 5		GLADDING 73	CNTR	2.9–4.7 γp
767 ± 4	1930	BALLAM 72	HBC	2.8 γp
770 ± 4	2430	BALLAM 72	HBC	4.7 γp
765 ± 10		ALVENSLEB... 70	CNTR	$\gamma A, t < 0.01$
767.7± 1.9	140k	BIGGS 70	CNTR	$< 4.1 \gamma C \rightarrow \pi^+\pi^-C$
765 ± 5	4000	ASBURY 67B	CNTR	$\gamma + Pb$

• • • We do not use the following data for averages, fits, limits, etc. • • •

771 ± 2 79k ³ BREITWEG 98B ZEUS 50–100 γp

¹ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ – ω interference.

² From the parametrization according to SOEDING 66.

³ From the parametrization according to ROSS 66.

NODE=M009M0P
NODE=M009M0P

OCCUR=2

OCCUR=2

NODE=M009M0P;LINKAGE=AB
NODE=M009M0P;LINKAGE=B5
NODE=M009M0P;LINKAGE=B6

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
769.0 ± 0.9 OUR AVERAGE				
Error includes scale factor of 1.4. See the ideogram below.				
765 ± 6		BERTIN 97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
773 ± 1.6		WEIDENAUER 93	ASTE	$\bar{p}p \rightarrow \pi^+\pi^-\omega$
762.6 ± 2.6		AGUILAR-... 91	EHS	400 pp
770 ± 2		¹ HEYN 81	RVUE	Pion form factor
768 ± 4		^{2,3} BOHACIK 80	RVUE	
769 ± 3		⁴ WICKLUND 78	ASPK	3,4,6 $\pi^\pm N$
768 ± 1	76k	DEUTSCH... 76	HBC	16 π^+p
767 ± 4	4100	ENGLER 74	DBC	6 $\pi^+n \rightarrow \pi^+\pi^-p$
775 ± 4	32k	² PROTOPOP... 73	HBC	7.1 $\pi^+p, t < 0.4$
764 ± 3	6.8k	⁵ RATCLIFF 72	ASPK	15 $\pi^-p, t < 0.3$
774 ± 3	1.7k	REYNOLDS 69	HBC	2.26 π^-p
769.2 ± 1.5	13.3k	⁶ PISUT 68	RVUE	1.7–3.2 $\pi^-p, t < 10$

• • • We do not use the following data for averages, fits, limits, etc. • • •

774.34±0.18±0.35	970k	⁷ ABLIKIM 18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
772.93±0.18±0.34	970k	⁸ ABLIKIM 18C	BES3	$\eta'(958) \rightarrow \gamma\pi^+\pi^-$
773.5 ± 2.5		⁹ COLANGELO 01	RVUE	$\pi\pi \rightarrow \pi\pi$
762.3 ± 0.5 ± 1.2	600k	¹⁰ ABELE 99E	CBAR	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
777 ± 2	4.9k	¹¹ ADAMS 97	E665	470 $\mu p \rightarrow \mu XB$
770 ± 2		¹² BOGOLYUB... 97	MIRA	32 $\bar{p}p \rightarrow \pi^+\pi^-X$
768 ± 8		¹² BOGOLYUB... 97	MIRA	32 $pp \rightarrow \pi^+\pi^-X$
761.1 ± 2.9		DUBNICKA 89	RVUE	π form factor
777.4 ± 2.0		¹³ CHABAUD 83	ASPK	17 π^-p polarized
769.5 ± 0.7		^{2,3} LANG 79	RVUE	
770 ± 9		³ ESTABROOKS 74	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
773.5 ± 1.7	11.2k	¹⁴ JACOBS 72	HBC	2.8 π^-p
775 ± 3	2.2k	¹⁵ HYAMS 68	OSPK	11.2 π^-p

¹ HEYN 81 includes all spacelike and timelike F_π values until 1978.

² From pole extrapolation.

³ From phase shift analysis of GRAYER 74 data.

⁴ Phase shift analysis. Systematic errors added corresponding to spread of different fits.

⁵ Published values contain misprints. Corrected by private communication RATCLIFF 74.

⁶ Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDBERGER 64, ABOLINS 63.

⁷ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.

⁸ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.

⁹ Breit-Wigner mass from a phase-shift analysis of HYAMS 73 and PROTOPOPESCU 73 data.

¹⁰ Using relativistic Breit-Wigner and taking into account ρ – ω interference.

¹¹ Systematic errors not evaluated.

¹² Systematic effects not studied.

¹³ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P-wave intensity. CHABAUD 83 includes data of GRAYER 74.

NODE=M009M0R
NODE=M009M0R

OCCUR=2

OCCUR=2

NODE=M009M0R;LINKAGE=B0
NODE=M009M0R;LINKAGE=C0
NODE=M009M0R;LINKAGE=H
NODE=M009M0R;LINKAGE=X
NODE=M009M0R;LINKAGE=03
NODE=M009M0R;LINKAGE=R

NODE=M009M0R;LINKAGE=B

NODE=M009M0R;LINKAGE=C

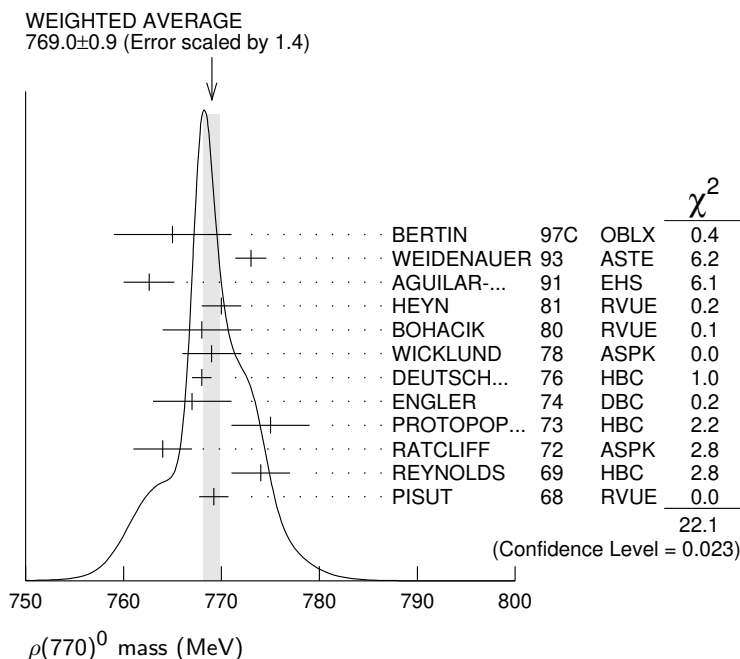
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NODE=M009M0R;LINKAGE=BL
NODE=M009M0R;LINKAGE=A1
NODE=M009M0R;LINKAGE=QQ
NODE=M009M0R;LINKAGE=G

¹⁴ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁵ Of HYAMS 68 six parametrizations, this is theoretically soundest. MR

NODE=M009M0R;LINKAGE=Z
NODE=M009M0R;LINKAGE=02



$m_{\rho(770)^0} - m_{\rho(770)^\pm}$

NODE=M009D

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
-0.7 $\pm$ 0.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
-2.4 $\pm$ 0.8		¹ SCHAEAL	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
0.4 $\pm$ 0.7 $\pm$ 0.6 1.98M		² ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3 $\pm$ 1.1 $\pm$ 2.0 500k		² ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.6 $\pm$ 0.6 $\pm$ 1.7 600k		ABELE	99E	CBAR $\pm$ 0	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 $\pm$ 4	3000	³ REYNOLDS	69	HBC -0	$2.26 \pi^- p$
-5 $\pm$ 5	3600	³ FOSTER	68	HBC $\pm$ 0	$0.0 \bar{p} p$
2.4 $\pm$ 2.1	22950	⁴ PISUT	68	RVUE	$\pi N \rightarrow \rho N$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
-3.37 $\pm$ 1.06		⁵ BARTOS	17A	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$, $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

NODE=M009D

¹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAEAL 05C and $e^+ e^-$ data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

² Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

³ From quoted masses of charged and neutral modes.

⁴ Includes MALAMUD 69, ARMENISE 68, BATON 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65, CARMONY 64, GOLDBERGER 64, ABOLINS 63.

⁵ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

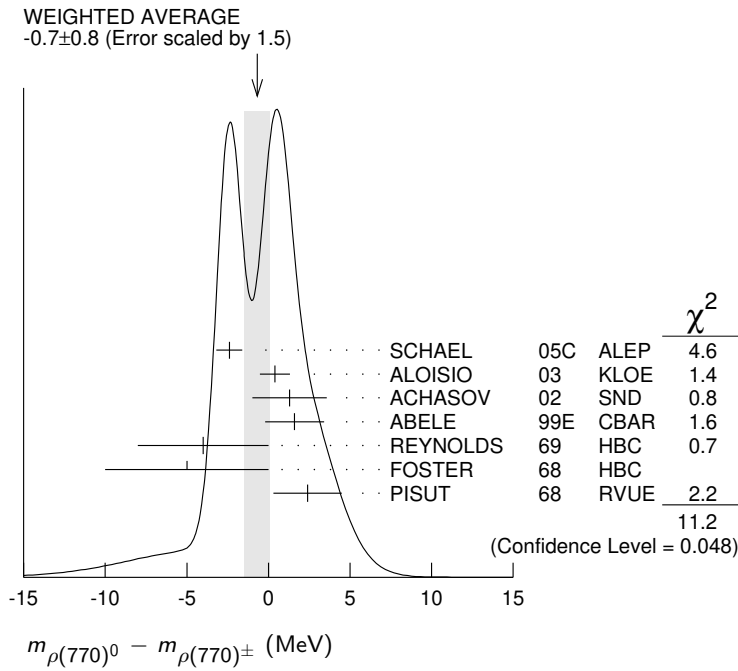
NODE=M009D;LINKAGE=SC

NODE=M009D;LINKAGE=CH

NODE=M009D;LINKAGE=A

NODE=M009D;LINKAGE=R

NODE=M009D;LINKAGE=B



$m_{\rho(770)^+} - m_{\rho(770)^-}$

NODE=M009D1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.5 \pm 0.8 \pm 0.7$	1.98M	¹ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
¹ Without limitations on masses and widths.				

NODE=M009D1

NODE=M009D;LINKAGE=WO

$\rho(770)$ RANGE PARAMETER

NODE=M009R

The range parameter R enters an energy-dependent correction to the width, of the form $(1 + q_r^2 R^2) / (1 + q^2 R^2)$, where q is the momentum of one of the pions in the $\pi\pi$ rest system. At resonance, $q = q_r$.

NODE=M009R

VALUE (GeV^{-1})	DOCUMENT ID	TECN	CHG	COMMENT
$5.3^{+0.9}_{-0.7}$	¹ CHABAUD	83 ASPK	0	$17 \pi^- p$ polarized
¹ The old PISUT 68 value, properly corrected, was 3.2 ± 0.6 .				

NODE=M009R

NODE=M009R;LINKAGE=01

$\rho(770)$ WIDTH

NODE=M009220

We no longer list S -wave Breit-Wigner fits, or data with high combinatorial background.

NODE=M009220

NEUTRAL ONLY, $e^+ e^-$

NODE=M009W0
NODE=M009W0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
147.4 ± 0.8	OUR AVERAGE	Error includes scale factor of 2.0. See the ideogram below.		
$145.6 \pm 0.6 \pm 0.8$		¹ ACHASOV	21 SND	$e^+ e^- \rightarrow \pi^+ \pi^-$
149.59 ± 0.67		² LEES	12G BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$145.98 \pm 0.75 \pm 0.50$	900k	³ AKHMETSHIN	07	$e^+ e^- \rightarrow \pi^+ \pi^-$
$146.1 \pm 0.8 \pm 1.5$	800k	^{4,5} ACHASOV	06 SND	$e^+ e^- \rightarrow \pi^+ \pi^-$
$143.85 \pm 1.33 \pm 0.80$	114k	^{6,7} AKHMETSHIN	04 CMD2	$e^+ e^- \rightarrow \pi^+ \pi^-$
$147.3 \pm 1.5 \pm 0.7$	1.98M	⁸ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$151.1 \pm 2.6 \pm 3.0$	500k	⁸ ACHASOV	02 SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.5 ± 3.0		⁹ BARKOV	85 OLYA	$e^+ e^- \rightarrow \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

144.06±0.85		10 BARTOS	17 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
144.56±0.80		11 BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
143.9 ±1.3 ±1.1	1.98M	12 ALOISIO	03 KLOE	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-}{\pi^+\pi^- \pi^0}$	OCCUR=2
147.4 ±1.5 ±0.7	1.98M	13 ALOISIO	03 KLOE	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-}{\pi^+\pi^- \pi^0}$	OCCUR=3
149.8 ±2.2 ±2.0	500k	14 ACHASOV	02 SND	$1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-}{\pi^+\pi^- \pi^0}$	OCCUR=3
147.9 ±1.5 ±7.5		15 BENAYOUN	98 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$	
153.5 ±1.3 ±4.6		16 GARDNER	98 RVUE	$0.28-0.92 \frac{e^+e^- \rightarrow \pi^+\pi^-}{\pi^+\pi^-}$	
145.0 ±1.7		17 O'CONNELL	97 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
142.5 ±3.5		18 BERNICHA	94 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	
138 ±1		19 GESHKEN...	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$	

¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.

NODE=M009W0;LINKAGE=D

² Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

NODE=M009W0;LINKAGE=LE

³ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

NODE=M009W;LINKAGE=AK

⁴ Supersedes ACHASOV 05A.

NODE=M009W0;LINKAGE=AC

⁵ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

NODE=M009W0;LINKAGE=SN

⁶ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

NODE=M009W5;LINKAGE=GS

⁷ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.

NODE=M009W5;LINKAGE=P2

⁸ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

NODE=M009W;LINKAGE=CH

⁹ From the GOUNARIS 68 parametrization of the pion form factor.

NODE=M009W;LINKAGE=K

¹⁰ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

NODE=M009W0;LINKAGE=A

¹¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

NODE=M009W0;LINKAGE=B

¹² Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.

NODE=M009W;LINKAGE=DF

¹³ Without limitations on masses and widths.

NODE=M009W;LINKAGE=WO

¹⁴ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.

NODE=M009W;LINKAGE=HC

¹⁵ Using the data of BARKOV 85 in the hidden local symmetry model.

NODE=M009W;LINKAGE=K2

¹⁶ From the fit to $e^+e^- \rightarrow \pi^+\pi^-$ data from the compilations of HEYN 81 and BARKOV 85, including the GOUNARIS 68 parametrization of the pion form factor.

NODE=M009W;LINKAGE=G8

¹⁷ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.

NODE=M009W;LINKAGE=AB

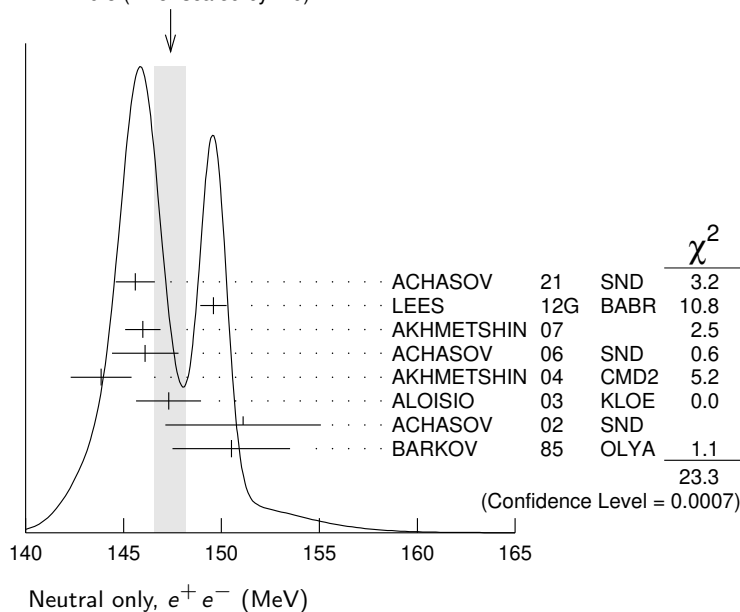
¹⁸ Applying the S-matrix formalism to the BARKOV 85 data.

NODE=M009W;LINKAGE=AA

¹⁹ Includes BARKOV 85 data. Model-dependent width definition.

NODE=M009W;LINKAGE=F

WEIGHTED AVERAGE
147.4±0.8 (Error scaled by 2.0)



CHARGED ONLY, τ DECAYS and e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
149.1 ± 0.8 OUR FIT					
149.1 ± 0.8 OUR AVERAGE					
148.1 ± 0.4 ± 1.7 5.4M	^{1,2}	FUJIKAWA 08	BELL	$\pm$	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0 ± 1.2	^{2,3}	SCHAELE 05c	ALEP		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9 ± 2.3 ± 2.0 500k	⁴	ACHASOV 02	SND	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.4 ± 1.4 ± 1.4 87k	^{5,6}	ANDERSON 00A	CLE2		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
139.90 ± 0.46	⁷	BARTOS 17A	RVUE		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
143.7 ± 1.3 ± 1.2 1.98M	⁴	ALOISIO 03	KLOE	$\pm$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
142.9 ± 1.3 ± 1.4 1.98M	⁸	ALOISIO 03	KLOE	$-$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
144.7 ± 1.4 ± 1.2 1.98M	⁸	ALOISIO 03	KLOE	$+$	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.2 ± 2.0 ± 0.7 -1.6	⁹	SANZ-CILLERO 03	RVUE		$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
150.9 ± 2.2 ± 2.0 500k	¹⁰	ACHASOV 02	SND		$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W5
NODE=M009W5

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

¹ $|F_\pi(0)|^2$ fixed to 1.² From the GOUNARIS 68 parametrization of the pion form factor.³ The error combines statistical and systematic uncertainties. Supersedes BARATE 97M.⁴ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.⁵ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.⁶ From the GOUNARIS 68 parametrization of the pion form factor. The second error is a model error taking into account different parametrizations of the pion form factor.⁷ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of FUJIKAWA 08.⁸ Without limitations on masses and widths.⁹ Using the data of BARATE 97M and the effective chiral Lagrangian.¹⁰ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0 \pi \pi} = g_{\rho^\pm \pi \pi}$.

NODE=M009W5;LINKAGE=FU
NODE=M009W5;LINKAGE=GO
NODE=M009W5;LINKAGE=SC

NODE=M009W5;LINKAGE=CH
NODE=M009W5;LINKAGE=A6
NODE=M009W5;LINKAGE=K1

NODE=M009W5;LINKAGE=A

NODE=M009W5;LINKAGE=WO
NODE=M009W5;LINKAGE=Z

NODE=M009W5;LINKAGE=HC

MIXED CHARGES, OTHER REACTIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
149.5 ± 1.3	600k	¹ ABELE 99E	CBAR	0 $\pm$	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$

¹ Assuming the equality of ρ^+ and ρ^- masses and widths.

NODE=M009W7
NODE=M009W7

NODE=M009W;LINKAGE=LB

CHARGED ONLY, HADROPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150.2 ± 2.4 OUR FIT					
150.2 ± 2.4 OUR AVERAGE					
152.8 ± 4.3		ABELE 97	CBAR		$\bar{p} n \rightarrow \pi^- \pi^0 \pi^0$
155 ± 11 2.9k	¹	CAPRARO 87	SPEC	$-$	200 $\pi^- \text{Cu} \rightarrow \pi^- \pi^0 \text{Cu}$
154 ± 20 967	¹	CAPRARO 87	SPEC	$-$	200 $\pi^- \text{Pb} \rightarrow \pi^- \pi^0 \text{Pb}$
150 ± 5		HUSTON 86	SPEC	$+$	202 $\pi^+ \text{A} \rightarrow \pi^+ \pi^0 \text{A}$
146 ± 12 6.5k	²	BYERLY 73	OSPK	$-$	5 $\pi^- p$
148.2 ± 4.1 9.6k	³	PISUT 68	RVUE	$-$	1.7–3.2 $\pi^- p$, $t < 10$
146 ± 13 900		EISNER 67	HBC	$-$	4.2 $\pi^- p$, $t < 10$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

137.0 ± 0.4 ⁴ ABLIKIM 17 BES3 $J/\psi \rightarrow \gamma 3\pi$ ¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.² Phase shift analysis. Systematic errors added corresponding to spread of different fits.³ From fit of 3-parameter relativistic P -wave Breit-Wigner to total mass distribution. Includes BATON 68, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, BLIEDEN 65 and CARMONY 64.⁴ S-matrix pole at a fixed ρ meson mass of 775.49 MeV.

NODE=M009W2
NODE=M009W2

OCCUR=2

NODE=M009W2;LINKAGE=Z
NODE=M009W2;LINKAGE=X
NODE=M009W2;LINKAGE=A1

NODE=M009W2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.5 ± 1.9 -2.1 OUR AVERAGE				
151.3 ± 2.2 ± 1.6 -2.8 900k		ANDREEV 20	H1	$ep \rightarrow e\pi^+\pi^-p$
155 ± 5 ± 2 63.5k	¹	ABRAMOWICZ 12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
146 ± 3 ± 13 79k	²	BREITWEG 98B	ZEUS	50–100 γp
150.9 ± 3.0		BARTALUCCI 78	CNTR	$\gamma p \rightarrow e^+e^-p$

NODE=M009W0P
NODE=M009W0P

• • • We do not use the following data for averages, fits, limits, etc. • • •

138 ± 3	79k	³ BREITWEG	98B	ZEUS	50–100 γp
147 ± 11		GLADDING	73	CNTR	2.9–4.7 γp
155 ± 12	2430	BALLAM	72	HBC	4.7 γp
145 ± 13	1930	BALLAM	72	HBC	2.8 γp
140 ± 5		ALVENSLEB...	70	CNTR	γA , $t < 0.01$
146.1 ± 2.9	140k	BIGGS	70	CNTR	$< 4.1 \gamma C \rightarrow \pi^+ \pi^- C$
160 ± 10		LANZEROTTI	68	CNTR	γp
130 ± 5	4000	ASBURY	67B	CNTR	$\gamma + Pb$

OCCUR=2

OCCUR=2

¹ Using the KUHN 90 parametrization of the pion form factor, neglecting ρ - ω interference.

² From the parametrization according to SOEDING 66.

³ From the parametrization according to ROSS 66.

NODE=M009W0P;LINKAGE=AB

NODE=M009W;LINKAGE=B5

NODE=M009W;LINKAGE=B6

NEUTRAL ONLY, OTHER REACTIONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
150.9 ± 1.7 OUR AVERAGE		Error includes scale factor of 1.1.		
122 ± 20		BERTIN	97C	OBLX $0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
145.7 ± 5.3		WEIDENAUER	93	ASTE $\bar{p} p \rightarrow \pi^+ \pi^- \omega$
144.9 ± 3.7		DUBNICKA	89	RVUE π form factor
148 ± 6		^{1,2} BOHACIK	80	RVUE
152 ± 9		³ WICKLUND	78	ASPK $3,4,6 \pi^\pm p N$
154 ± 2	76k	DEUTSCH...	76	HBC $16 \pi^+ p$
157 ± 8	6.8k	⁴ RATCLIFF	72	ASPK $15 \pi^- p$, $t < 0.3$
143 ± 8	1.7k	REYNOLDS	69	HBC $2.26 \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

150.85 ± 0.55 ± 0.67	970k	⁵ ABLIKIM	18C	BES3	$\eta'(958) \rightarrow \gamma \pi^+ \pi^-$
150.18 ± 0.55 ± 0.65	970k	⁶ ABLIKIM	18C	BES3	$\eta'(958) \rightarrow \gamma \pi^+ \pi^-$
147.0 ± 2.5	600k	⁷ ABELE	99E	CBAR	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
146 ± 3	4.9k	⁸ ADAMS	97	E665	$470 \mu p \rightarrow \mu X B$
160.0 + 4.1 - 4.0		⁹ CHABAUD	83	ASPK	$17 \pi^- p$ polarized
155 ± 1		¹⁰ HEYN	81	RVUE	π form factor
148.0 ± 1.3		^{1,2} LANG	79	RVUE	
146 ± 14	4.1k	ENGLER	74	DBC	$6 \pi^+ n \rightarrow \pi^+ \pi^- p$
143 ± 13		² ESTABROOKS	74	RVUE	$17 \pi^- p \rightarrow \pi^+ \pi^- n$
160 ± 10	32k	¹ PROTOPOP...	73	HBC	$7.1 \pi^+ p$, $t < 0.4$
145 ± 12	2.2k	^{3,11} HYAMS	68	OSPK	$11.2 \pi^- p$
163 ± 15	13.3k	¹² PISUT	68	RVUE	$1.7-3.2 \pi^- p$, $t < 10$

OCCUR=2

¹ From pole extrapolation.

² From phase shift analysis of GRAYER 74 data.

³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁴ Published values contain misprints. Corrected by private communication RATCLIFF 74.

⁵ From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.

⁶ From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.

⁷ Using relativistic Breit-Wigner and taking into account ρ - ω interference.

⁸ Systematic errors not evaluated.

⁹ From fit of 3-parameter relativistic Breit-Wigner to helicity-zero part of P -wave intensity. CHABAUD 83 includes data of GRAYER 74.

¹⁰ HEYN 81 includes all spacelike and timelike F_π values until 1978.

¹¹ Of HYAMS 68 six parametrizations this is theoretically soundest. MR

¹² Includes MALAMUD 69, ARMENISE 68, BACON 67, HUWE 67, MILLER 67B, ALFF-STEINBERGER 66, HAGOPIAN 66, HAGOPIAN 66B, JACOBS 66B, JAMES 66, WEST 66, GOLDBERGER 64, ABOLINS 63.

NODE=M009W;LINKAGE=C

NODE=M009W;LINKAGE=H

NODE=M009W;LINKAGE=Z

NODE=M009W;LINKAGE=03

NODE=M009W0R;LINKAGE=B

NODE=M009W0R;LINKAGE=C

NODE=M009W;LINKAGE=BL

NODE=M009W;LINKAGE=A1

NODE=M009W;LINKAGE=G

NODE=M009W;LINKAGE=B

NODE=M009W;LINKAGE=02

NODE=M009W;LINKAGE=R

$\Gamma_{\rho(770)^0} - \Gamma_{\rho(770)^\pm}$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.3 ± 1.3 OUR AVERAGE		Error includes scale factor of 1.4.		
-0.2 ± 1.0		¹ SCHAEAL	05C	ALEP $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
3.6 ± 1.8 ± 1.7	1.98M	² ALOISIO	03	KLOE $1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.66 ± 0.85		³ BARTOS	17A	RVUE $e^+ e^- \rightarrow \pi^+ \pi^-, \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M009W6

NODE=M009W6

¹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAEEL 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

² Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

$$\Gamma_{\rho(770)^+} = \Gamma_{\rho(770)^-}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.8 \pm 2.0 \pm 0.5$	1.98M	¹ ALOISIO	03	KLOE $1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

¹ Without limitations on masses and widths.

NODE=M009W6;LINKAGE=SC

NODE=M009W6;LINKAGE=CH

NODE=M009W6;LINKAGE=A

NODE=M009W16

NODE=M009W16

NODE=M009W16;LINKAGE=WO

NODE=M009225;NODE=M009

$\rho(770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	~ 100	%
$\rho(770)^\pm$ decays		
$\Gamma_2 \quad \pi^\pm \pi^0$	~ 100	%
$\Gamma_3 \quad \pi^\pm \gamma$	$(4.5 \pm 0.5) \times 10^{-4}$	S=2.2
$\Gamma_4 \quad \pi^\pm \eta$	$< 6 \times 10^{-3}$	CL=84%
$\Gamma_5 \quad \pi^\pm \pi^+ \pi^- \pi^0$	$< 2.0 \times 10^{-3}$	CL=84%
$\rho(770)^0$ decays		
$\Gamma_6 \quad \pi^+ \pi^-$	~ 100	%
$\Gamma_7 \quad \pi^+ \pi^- \gamma$	$(9.9 \pm 1.6) \times 10^{-3}$	
$\Gamma_8 \quad \pi^0 \gamma$	$(4.7 \pm 0.8) \times 10^{-4}$	S=1.7
$\Gamma_9 \quad \eta \gamma$	$(3.00 \pm 0.21) \times 10^{-4}$	
$\Gamma_{10} \quad \pi^0 \pi^0 \gamma$	$(4.5 \pm 0.8) \times 10^{-5}$	
$\Gamma_{11} \quad \mu^+ \mu^-$	[a] $(4.55 \pm 0.28) \times 10^{-5}$	
$\Gamma_{12} \quad e^+ e^-$	[a] $(4.72 \pm 0.05) \times 10^{-5}$	
$\Gamma_{13} \quad \pi^+ \pi^- \pi^0$	$(1.01^{+0.54}_{-0.36} \pm 0.34) \times 10^{-4}$	
$\Gamma_{14} \quad \pi^+ \pi^- \pi^+ \pi^-$	$(1.8 \pm 0.9) \times 10^{-5}$	
$\Gamma_{15} \quad \pi^+ \pi^- \pi^0 \pi^0$	$(1.6 \pm 0.8) \times 10^{-5}$	
$\Gamma_{16} \quad \pi^0 e^+ e^-$	$< 1.2 \times 10^{-5}$	CL=90%
$\Gamma_{17} \quad \eta e^+ e^-$		

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M009;CLUMP=A

DESIG=11;OUR EVAL;→ UNCHECKED ←

DESIG=3

DESIG=5

DESIG=21

NODE=M009;CLUMP=B

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=22

DESIG=30

DESIG=9

DESIG=10

[a] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \rightarrow \mu^+ \mu^-) = \Gamma(\rho^0 \rightarrow e^+ e^-) \times 0.99785$.

LINKAGE=MD2

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 10 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 10.7$ for 8 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_3	-100
Γ	$15 \quad -15$
	$x_2 \quad x_3$

Mode	Rate (MeV)	Scale factor
$\Gamma_2 \quad \pi^\pm \pi^0$	150.2 ± 2.4	
$\Gamma_3 \quad \pi^\pm \gamma$	0.068 ± 0.007	2.3

DESIG=11

DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 7 branching ratios uses 21 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 9.5$ for 13 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_7	-100							
x_8	-5	0						
x_9	-1	0	1					
x_{10}	-1	0	0	0				
x_{11}	2	-3	0	0	0			
x_{12}	0	0	-6	-9	0	0		
x_{14}	-1	0	0	0	0	0	0	
Γ	0	0	3	5	0	0	-54	0
	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{14}

Mode	Rate (MeV)	Scale factor
Γ_6 $\pi^+ \pi^-$	147.5 $\pm$ 0.9	
Γ_7 $\pi^+ \pi^- \gamma$	1.48 $\pm$ 0.24	
Γ_8 $\pi^0 \gamma$	0.070 $\pm$ 0.012	1.7
Γ_9 $\eta \gamma$	0.0447 $\pm$ 0.0032	
Γ_{10} $\pi^0 \pi^0 \gamma$	0.0066 $\pm$ 0.0012	
Γ_{11} $\mu^+ \mu^-$	[a] 0.0068 $\pm$ 0.0004	
Γ_{12} $e^+ e^-$	[a] 0.00704 $\pm$ 0.00006	
Γ_{14} $\pi^+ \pi^- \pi^+ \pi^-$	0.0027 $\pm$ 0.0014	

DESIG=12

DESIG=60

DESIG=40

DESIG=8

DESIG=80

DESIG=6

DESIG=4

DESIG=22

$\rho(770)$ PARTIAL WIDTHS

NODE=M009230

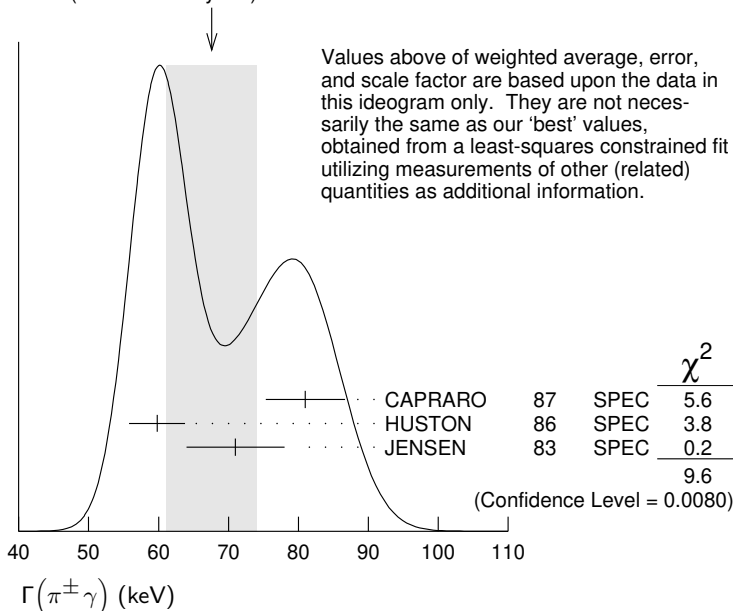
 $\Gamma(\pi^\pm \gamma)$ Γ_3

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
68 $\pm$ 7 OUR FIT	Error includes scale factor of 2.3.			
68 $\pm$ 7 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.			
81 $\pm$ 4 $\pm$ 4	CAPRARO	87	SPEC	- 200 $\pi^- A \rightarrow \pi^- \pi^0 A$
59.8 $\pm$ 4.0	HUSTON	86	SPEC	+ 202 $\pi^+ A \rightarrow \pi^+ \pi^0 A$
71 $\pm$ 7	JENSEN	83	SPEC	- 156-260 $\pi^- A \rightarrow \pi^- \pi^0 A$

NODE=M009W3

NODE=M009W3

WEIGHTED AVERAGE
68 $\pm$ 7 (Error scaled by 2.2)



$\Gamma(\pi^0\gamma)$ Γ_8

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$77 \pm 17 \pm 11$	36500	¹ ACHASOV	03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
121 ± 31		DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$

¹ Using $\Gamma_{\text{total}} = 147.9 \pm 1.3$ MeV and $B(\rho \rightarrow \pi^0\gamma)$ from ACHASOV 03.

NODE=M009W31
NODE=M009W31

NODE=M009W31;LINKAGE=AV

 $\Gamma(\eta\gamma)$ Γ_9

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

62 ± 17		¹ DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$

¹ Solution corresponding to constructive ω - ρ interference.

NODE=M009W32
NODE=M009W32

NODE=M009W32;LINKAGE=L

 $\Gamma(e^+e^-)$ Γ_{12}

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

7.04 $\pm$ 0.06 OUR FIT

7.04 $\pm$ 0.06 OUR AVERAGE

$7.048 \pm 0.057 \pm 0.050$	900k	¹ AKHMETSHIN	07		$e^+e^- \rightarrow \pi^+\pi^-$
$7.06 \pm 0.11 \pm 0.05$	114k	^{2,3} AKHMETSHIN	04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
$6.77 \pm 0.10 \pm 0.30$		BARKOV	85	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.12 \pm 0.02 \pm 0.11$	800k	⁴ ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
6.3 ± 0.1		⁵ BENAYOUN	98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$

¹ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

² Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

³ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.

⁴ Supersedes ACHASOV 05A.

⁵ Using the data of BARKOV 85 in the hidden local symmetry model.

NODE=M009W4
NODE=M009W4

OCCUR=2

NODE=M009W4;LINKAGE=AK
NODE=M009W4;LINKAGE=GS
NODE=M009W4;LINKAGE=P2
NODE=M009W4;LINKAGE=AC
NODE=M009W4;LINKAGE=K2

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)$ Γ_{14}

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.8 \pm 1.4 \pm 0.5$	153	AKHMETSHIN	00	CMD2	$0.6-0.97 e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M009W33
NODE=M009W33

 $\rho(770) \Gamma(e^+e^-) \Gamma(i) / \Gamma^2(\text{total})$

NODE=M009233

 $\Gamma(e^+e^-) / \Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-) / \Gamma_{\text{total}}$ $\Gamma_{12} / \Gamma \times \Gamma_6 / \Gamma$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

4.89 $\pm$ 0.04 OUR AVERAGE

$4.889 \pm 0.015 \pm 0.039$		¹ ACHASOV	21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
$4.876 \pm 0.023 \pm 0.064$	800k	^{2,3} ACHASOV	06	SND	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.72 ± 0.02		⁴ BENAYOUN	10	RVUE	$0.4-1.05 e^+e^-$

¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances.

² Supersedes ACHASOV 05A.

³ A fit of the SND data from 400 to 1000 MeV using parameters of the $\rho(1450)$ and $\rho(1700)$ from a fit of the data of BARKOV 85, BISELLO 89 and ANDERSON 00A.

⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G4;LINKAGE=A

NODE=M009G4;LINKAGE=AC
NODE=M009G4;LINKAGE=SN

NODE=M009G4;LINKAGE=BE

 $\Gamma(e^+e^-) / \Gamma_{\text{total}} \times \Gamma(\eta\gamma) / \Gamma_{\text{total}}$ $\Gamma_{12} / \Gamma \times \Gamma_9 / \Gamma$

VALUE (units 10^{-8})	EVTs	DOCUMENT ID	TECN	COMMENT

1.42 $\pm$ 0.10 OUR FIT

1.45 $\pm$ 0.12 OUR AVERAGE

$1.32 \pm 0.14 \pm 0.08$	33k	¹ ACHASOV	07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
$1.50 \pm 0.65 \pm 0.09$	17.4k	² AKHMETSHIN	05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
$1.61 \pm 0.20 \pm 0.11$	23k	^{3,4} AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.85 ± 0.49		⁵ DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.05 ± 0.02		⁶ BENAYOUN	10	RVUE	$0.4-1.05 e^+e^-$

NODE=M009G1
NODE=M009G1

- ¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
- ² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- ³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- ⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
- ⁵ Recalculated by us from the cross section in the peak.
- ⁶ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M009G1;LINKAGE=AH

NODE=M009G;LINKAGE=AH

NODE=M009G;LINKAGE=AK

NODE=M009G;LINKAGE=BQ

NODE=M009G;LINKAGE=LP

NODE=M009G1;LINKAGE=BE

NODE=M009G2

NODE=M009G2

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-8}) EVTS DOCUMENT ID TECN COMMENT

2.2 ± 0.4 OUR FIT Error includes scale factor of 1.7.

2.21 ± 0.34 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

1.98 $\pm 0.22 \pm 0.10$ ¹ ACHASOV 16A SND 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

2.90 $^{+0.60}_{-0.55} \pm 0.18$ 18k AKHMETSHIN 05 CMD2 0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$

3.61 $\pm 0.74 \pm 0.49$ 10k ² DOLINSKY 89 ND $e^+e^- \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.875 ± 0.026 ³ BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

2.37 $\pm 0.53 \pm 0.33$ 36k ⁴ ACHASOV 03 SND 0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$

- ¹ From the VMD model with the $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 03.

- ² Recalculated by us from the cross section in the peak.

- ³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

- ⁴ Using $\sigma_{\phi \rightarrow \pi^0\gamma}$ from ACHASOV 00 and $m_{\rho} = 775.97$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.

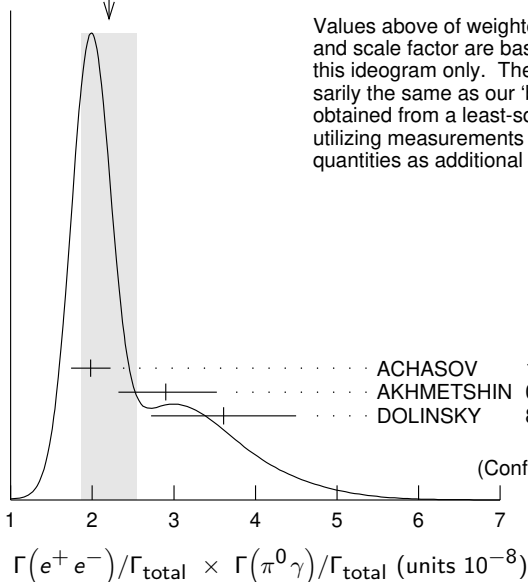
NODE=M009G2;LINKAGE=B

NODE=M009G2;LINKAGE=LP

NODE=M009G2;LINKAGE=BE

NODE=M009G;LINKAGE=SH

WEIGHTED AVERAGE
2.21 ± 0.34 (Error scaled by 1.6)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

			χ^2
ACHASOV	16A	SND	0.9
AKHMETSHIN	05	CMD2	1.4
DOLINSKY	89	ND	2.5
			4.8

(Confidence Level = 0.090)

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ $\Gamma_{12}/\Gamma \times \Gamma_{13}/\Gamma$

VALUE (units 10^{-9}) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.903 ± 0.076 ¹ BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

4.58 $^{+2.46}_{-1.64} \pm 1.56$ 1.2M ² ACHASOV 03D RVUE 0.44-2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

- ¹ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

- ² Statistical significance is less than 3σ .

NODE=M009G3

NODE=M009G3

NODE=M009G3;LINKAGE=BE

NODE=M009G3;LINKAGE=AC

$\rho(770)$ BRANCHING RATIOS

NODE=M009235

$\Gamma(\pi^\pm\eta)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE (units 10^{-4}) CL% DOCUMENT ID TECN CHG COMMENT

<60 84 FERBEL 66 HBC $\pm$ $\pi^\pm p$ above 2.5

NODE=M009R4

NODE=M009R4

$\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<20	84	FERBEL	66	HBC	$\pm$ $\pi^\pm p$ above 2.5
• • • We do not use the following data for averages, fits, limits, etc. • • •					
35 ± 40		JAMES	66	HBC	$+$ $2.1 \pi^+ p$

NODE=M009R1
 NODE=M009R1

 $\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0099$\pm$0.0016 OUR FIT				
0.0099$\pm$0.0016		¹ DOLINSKY	91	ND $e^+e^- \rightarrow \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0111 ± 0.0014		² VASSERMAN	88	ND $e^+e^- \rightarrow \pi^+\pi^-\gamma$
<0.005	90	³ VASSERMAN	88	ND $e^+e^- \rightarrow \pi^+\pi^-\gamma$

NODE=M009R12
 NODE=M009R12

- ¹ Bremsstrahlung from a decay pion and for photon energy above 50 MeV.
² Superseded by DOLINSKY 91.
³ Structure radiation due to quark rearrangement in the decay.

OCCUR=2

NODE=M009R12;LINKAGE=J
 NODE=M009R12;LINKAGE=I
 NODE=M009R12;LINKAGE=N

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.20 ± 0.52		¹ ACHASOV	16A	SND $0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
$6.21^{+1.28}_{-1.18} \pm 0.39$	18k	^{2,3} AKHMETSHIN	05	CMD2 $0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
$5.22 \pm 1.17 \pm 0.75$	36k	^{3,4} ACHASOV	03	SND $0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
6.8 ± 1.7		⁵ BENAYOUN	96	RVUE $0.54-1.04 e^+e^- \rightarrow \pi^0\gamma$
7.9 ± 2.0		³ DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\gamma$

- ¹ Using $B(\rho \rightarrow e^+e^-)$ from PDG 15. Supersedes ACHASOV 03.
² Using $B(\rho \rightarrow e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$.
³ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.
⁴ Using $B(\rho \rightarrow e^+e^-) = (4.54 \pm 0.10) \times 10^{-5}$.
⁵ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M009R9;LINKAGE=C
 NODE=M009R9;LINKAGE=AK
 NODE=M009R9;LINKAGE=BZ
 NODE=M009R9;LINKAGE=AS
 NODE=M009R9;LINKAGE=A

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.00$\pm$0.21 OUR FIT					
2.90$\pm$0.32 OUR AVERAGE					
$2.79 \pm 0.34 \pm 0.03$	33k	¹ ACHASOV	07B	SND	$0.6-1.38 e^+e^- \rightarrow \eta\gamma$
3.6 ± 0.9		² ANDREWS	77	CNTR	0 $6.7-10 \gamma\text{Cu}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.21 \pm 1.39 \pm 0.20$	17.4k	^{3,4} AKHMETSHIN	05	CMD2	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
$3.39 \pm 0.42 \pm 0.23$		^{2,5,6} AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
$1.9^{+0.6}_{-0.8}$		⁷ BENAYOUN	96	RVUE	$0.54-1.04 e^+e^- \rightarrow \eta\gamma$
4.0 ± 1.1		^{2,4} DOLINSKY	89	ND	$e^+e^- \rightarrow \eta\gamma$

- ¹ ACHASOV 07B reports $[\Gamma(\rho(770) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\rho(770) \rightarrow e^+e^-)] = (1.32 \pm 0.14 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\rho(770) \rightarrow e^+e^-) = (4.72 \pm 0.05) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.
² Solution corresponding to constructive ω - ρ interference.
³ Using $B(\rho \rightarrow e^+e^-) = (4.67 \pm 0.09) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
⁴ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.
⁵ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
⁶ Using $B(\rho \rightarrow e^+e^-) = (4.75 \pm 0.10) \times 10^{-5}$ from AKHMETSHIN 02 and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
⁷ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution. Constructive ρ - ω interference solution.

NODE=M009R7
 NODE=M009R7

NODE=M009R7;LINKAGE=AO

NODE=M009R7;LINKAGE=A
 NODE=M009R;LINKAGE=AK
 NODE=M009R7;LINKAGE=AZ
 NODE=M009R;LINKAGE=BQ

NODE=M009R;LINKAGE=BX

NODE=M009R7;LINKAGE=C

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{10}/Γ NODE=M009R14
NODE=M009R14 **4.5 ± 0.8 OUR FIT** **$4.5^{+0.9}_{-0.8}$ OUR AVERAGE**5.2 $^{+1.5}_{-1.3} \pm 0.6$ 190 ¹ AKHMETSHIN 04B CMD2 0.6–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

4.1 $^{+1.0}_{-0.9} \pm 0.3$ 295 ² ACHASOV 02F SND 0.36–0.97 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.8 $^{+3.4}_{-1.8} \pm 0.5$ 63 ³ ACHASOV 00G SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ This branching ratio includes the conventional VMD mechanism $\rho \rightarrow \omega\pi^0$, $\omega \rightarrow \pi^0\gamma$, and the new decay mode $\rho \rightarrow f_0(500)\gamma$, $f_0(500) \rightarrow \pi^0\pi^0$ with a branching ratio $(2.0^{+1.1}_{-0.9} \pm 0.3) \times 10^{-5}$ differing from zero by 2.0 standard deviations.

NODE=M009R14;LINKAGE=AH

² This branching ratio includes the conventional VMD mechanism $\rho \rightarrow \omega\pi^0$, $\omega \rightarrow \pi^0\gamma$ and the new decay mode $\rho \rightarrow f_0(500)\gamma$, $f_0(500) \rightarrow \pi^0\pi^0$ with a branching ratio $(1.9^{+0.9}_{-0.8} \pm 0.4) \times 10^{-5}$ differing from zero by 2.4 standard deviations. Supersedes ACHASOV 00G.

NODE=M009R;LINKAGE=FF

³ Superseded by ACHASOV 02F.

NODE=M009R;LINKAGE=GF

 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 Γ_{11}/Γ_6 NODE=M009R5
NODE=M009R5 **4.60 ± 0.28 OUR FIT** **$4.6 \pm 0.2 \pm 0.2$**

ANTIPOV

89

SIGM

 $\pi^- \text{Cu} \rightarrow \mu^+\mu^-\pi^-\text{Cu}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.2 $^{+1.6}_{-3.6}$ ¹ ROTHWELL 69 CNTR Photoproduction5.6 ± 1.5 ² WEHMANN 69 OSPK 12 $\pi^- \text{C, Fe}$ 9.7 $^{+3.1}_{-3.3}$ ^{3,4} HYAMS 67 OSPK 11 $\pi^- \text{Li, H}$

¹ Possibly large ρ - ω interference leads us to increase the minus error.

NODE=M009R5;LINKAGE=R

² Result contains $11 \pm 11\%$ correction using SU(3) for central value. The error on the correction takes account of possible ρ - ω interference and the upper limit agrees with the upper limit of $\omega \rightarrow \mu^+\mu^-$ from this experiment.

NODE=M009R5;LINKAGE=W

³ But he even enlarges his error to take residual ω contamination into account. Since his value is high, seems the other experiments also can't have too many ω 's. But maybe Hyams has additional μ 's from $\rho \rightarrow \pi\pi$, decaying π 's.

NODE=M009R5;LINKAGE=01

⁴ HYAMS 67's mass resolution is 20 MeV. The ω region was excluded.

NODE=M009R5;LINKAGE=H

 $\Gamma(e^+e^-)/\Gamma(\pi\pi)$ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 Γ_{12}/Γ_1 NODE=M009R3
NODE=M009R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.40 ± 0.05 ^{1,2} BENAKSAS 72 OSPK $e^+e^- \rightarrow \pi^+\pi^-$

¹ The ρ' contribution is not taken into account.

NODE=M009R;LINKAGE=KS

² Barkov excludes Auslender and Benaksas for large statistical and systematic errors.

NODE=M009R3;LINKAGE=01

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{13}/Γ NODE=M009R10
NODE=M009R10 **$0.88 \pm 0.23 \pm 0.30$** ¹ LEES

21B

BABR

10.5 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.01 $^{+0.54}_{-0.36} \pm 0.34$ 1.2M ² ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ <1.2 90 VASSERMAN 88B ND $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. Statistical evidence is more than 6σ .

NODE=M009R10;LINKAGE=A

² Statistical significance is less than 3σ .

NODE=M009R;LINKAGE=NS

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi\pi)$

VALUE

CL%

DOCUMENT ID

TECN

CHG

COMMENT

 Γ_{13}/Γ_1 NODE=M009R6
NODE=M009R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

~0.01 BRAMON 86 RVUE 0 $J/\psi \rightarrow \omega\pi^0$ <0.01 84 ¹ ABRAMS 71 HBC 0 $3.7\pi^+\pi^-$

¹ Model dependent, assumes $I = 1, 2$, or 3 for the 3π system.

NODE=M009R6;LINKAGE=G

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.8 ± 0.9 OUR FIT					
$1.8 \pm 0.9 \pm 0.3$	153		AKHMETSHIN 00	CMD2	$0.6-0.97 \ e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<20	90		KURDADZE 88	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M009R13
NODE=M009R13

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma(\pi\pi)$
 Γ_{14}/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<15	90	ERBE	69	HBC	0 2.5-5.8 γp
<20		CHUNG	68	HBC	0 3.2,4.2 $\pi^- p$
<20	90	HUSON	68	HLBC	0 16.0 $\pi^- p$
<80		JAMES	66	HBC	0 2.1 $\pi^+ p$

NODE=M009R11
NODE=M009R11

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$
 Γ_{15}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
$1.60 \pm 0.74 \pm 0.18$		¹ ACHASOV 09A	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4	90	AULCHENKO 87C	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
<20	90	KURDADZE 86	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M009R8
NODE=M009R8

¹ Assuming no interference between the ρ and ω contributions.

NODE=M009R8;LINKAGE=AC

 $\Gamma(\pi^0e^+e^-)/\Gamma_{\text{total}}$
 Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	ACHASOV 08	SND	$0.36-0.97 \ e^+e^- \rightarrow \pi^0e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.6		AKHMETSHIN 05A	CMD2	$0.72-0.84 \ e^+e^-$

NODE=M009R15
NODE=M009R15

 $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$
 Γ_{17}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.7	AKHMETSHIN 05A	CMD2	$0.72-0.84 \ e^+e^-$

NODE=M009R16
NODE=M009R16

$\rho(770)$ REFERENCES

ACHASOV 21	JHEP 2101 113	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61040
LEES 21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
ANDREEV 20	EPJ C80 1189	V. Andreev <i>et al.</i>	(H1 Collab.)	REFID=60773
ABLIKIM 18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ABLIKIM 17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57650
BARTOS 17	PR D96 113004	E. Bartos <i>et al.</i>		REFID=58325
BARTOS 17A	IJMP A32 1750154	E. Bartos <i>et al.</i>		REFID=58367
ABLIKIM 16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57138
ACHASOV 16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57513
PDG 15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=2
ABRAMOWICZ 12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
LEES 12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
AMBROSINO 11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
GARCIA-MAR... 11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=16761
BATLEY 10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53567
BENAYOUN 10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
DUBNICKA 10	APS 60 1	S. Dubnicka, A.Z. Dubnickova		REFID=58797
ACHASOV 09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
AUBERT 09AS	Translated from ZETF 136 442.			
ACHASOV 08	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
	Translated from ZETF 134 80.			
FUJIKAWA 08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
ACHASOV 07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN 07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV 06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
	Translated from ZETF 130 437.			
ACHASOV 06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO 06A	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
	Translated from ZETFP 84 491.			
ACHASOV 05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
	Translated from ZETF 128 1201.			
AKHMETSHIN 05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN 05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
ALOISIO 05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
AULCHENKO 05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
	Translated from ZETFP 82 841.			

NODE=M009

SCHAEEL	05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)	REFID=50845
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
SANZ-CILLERO	03	EPJ C27 587	J.J. Sanz-Cillero, A. Pich		REFID=49399
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
COLANGELO	01	NP B603 125	G. Colangelo, J. Gasser, H. Leytwyler		REFID=49180
PICH	01	PR D63 093005	A. Pich, J. Portoles		REFID=48313
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 72 411.	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47421
AKHMETSHIN	00	Translated from ZETFP 71 519.	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47468
ANDERSON	00A	PL B475 190	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47414
ABELE	99E	PR D61 112002	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45859
BENAYOUN	98	PL B469 270	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADL+)	REFID=46354
BREITWEG	98B	EPJ C2 269	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46366
GARDNER	98	EPJ C2 247	S. Gardner, H.B. O'Connell		REFID=47981
Also		PR D57 2716	S. Gardner, H.B. O'Connell		REFID=45415
ABELE	97	PR D62 019903 (err.)	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45533
ADAMS	97	PL B391 191	M.R. Adams <i>et al.</i>	(E665 Collab.)	REFID=45622
BARATE	97M	ZPHY C74 237	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45701
BERTIN	97C	ZPHY C76 15	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45393
BOGOLYUB...	97	PL B408 476	M.Y. Bogolyubsky <i>et al.</i>	(MOSU, SERP)	REFID=45860
O'CONNELL	97	PAN 60 46	H.B. O'Connell <i>et al.</i>	(ADLD)	REFID=45753
BENAYOUN	96	Translated from YAF 60 53.	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=44097
BERNICA	94	NP A623 559	A. Bernica, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=43589
WEIDENAUER	93	ZPHY C72 221	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41637
AGUILAR...	91	PR D50 4454	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41369
DOLINSKY	91	ZPHY C59 387	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=45862
KUHN	90	ZPHY C50 405	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=40739
ANTIPOV	89	PRPL 202 99	Y.M. Antipov <i>et al.</i>	(SERP, JINR, BGNA+)	REFID=40740
BISELLO	89	ZPHY C48 445	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41003
DOLINSKY	89	ZPHY C42 185	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=44082
DUBNICKA	89	PL B220 321	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=41017
GESHKEN...	89	ZPHY G15 1349	B.V. Geshkenbein	(ITEP)	REFID=41121
KURDADZE	88	ZPHY C45 351	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41019
VASSERMAN	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41020
VASSERMAN	88B	Translated from ZETFP 47 432.	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41370
AULCHENKO	87C	SJNP 47 1035	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40003
CAPRARO	87	Translated from YAF 47 1635.	L. Capraro <i>et al.</i>	(CLER, FRAS, MILA+)	REFID=22102
BRAMON	86	SJNP 48 480	A. Bramon, J. Casulleras	(BARC)	REFID=20137
HUSTON	86	IYF 87-90 Preprint	J. Huston <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=40287
KURDADZE	86	NP B288 659	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20134
BARKOV	85	PL B173 97	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20561
DRUZHININ	84	PR D33 3199	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20131
CHABAUD	83	JETPL 43 643	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20132
JENSEN	83	Translated from ZETFP 43 497.	T. Jensen <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20129
HEYN	81	NP B256 365	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20128
BOHACIK	80	PL 144B 136	J. Bohacik, H. Kuhnelt	(SLOV, WIEN)	REFID=20381
COHEN	80	PR D21 1342	D. Cohen <i>et al.</i>	(ANL)	REFID=20126
LANG	79	PR D22 2595	C.B. Lang, A. Mas-Parareda	(GRAZ)	REFID=20122
BARTALUCCI	78	NC 44A 587	S. Bartalucci <i>et al.</i>	(DESY, FRAS)	REFID=20124
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20120
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20119
DEUTSCH...	76	NP B103 426	M. Deuschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20110
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20111
ESTABROOKS	74	NP B79 301	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20113
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=40128
RATCLIFF	74	Private Comm.	W.L. Byerly <i>et al.</i>	(MICH)	REFID=20104
BYERLY	73	PR D7 637	G.E. Gladding <i>et al.</i>	(HARV)	REFID=20106
GLADDING	73	PR D8 3721	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
HYAMS	73	NP B64 134	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
PROTOPOP...	73	PR D7 1279	J. Ballam <i>et al.</i>	(SLAC, LBL, TUFTS)	REFID=20094
BALLAM	72	PR D5 545	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72	PL 39B 289	L.D. Jacobs	(SACL)	REFID=20101
JACOBS	72	PR D6 1291	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
RATCLIFF	72	PL 38B 345	G.S. Abrams <i>et al.</i>	(LBL)	REFID=20090
ABRAMS	71	PR D4 653	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20089
ALVENSLEB...	70	PRL 24 786	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20087
BIGGS	70	PRL 24 1197	R. Erbe <i>et al.</i>	(German Bubble Chamber Collab.)	REFID=20074
ERBE	69	PR 188 2060	E.I. Malamud, P.E. Schlein	(UCLA)	REFID=20077
MALAMUD	69	Argonne Conf. 93	B.G. Reynolds <i>et al.</i>	(FSU)	REFID=20080
REYNOLDS	69	PR 184 1424	P.L. Rothwell <i>et al.</i>	(NEAS)	REFID=20082
ROTHWELL	69	PRL 23 1521	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
WEHMANN	69	PR 178 2095	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
ARMENISE	68	NC 54A 999	J.P. Baton, G. Laurens	(SACL)	REFID=20056
BATON	68	PR 176 1574	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CHUNG	68	PR 165 1491	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=20061
FOSTER	68	NP B6 107	G.J. Gounaris, J.J. Sakurai		REFID=48054
GOUNARIS	68	PRL 21 244	R. Huson <i>et al.</i>	(ORSAY, MILA, UCLA)	REFID=20062
HUSON	68	PL 28B 208	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20063
HYAMS	68	NP B7 1	L.J. Lanzerotti <i>et al.</i>	(HARV)	REFID=20068
LANZEROTTI	68	PR 166 1365	J. Pisut, M. Roos	(CERN)	REFID=20070
PISUT	68	NP B6 325	J.G. Asbury <i>et al.</i>	(DESY, COLU)	REFID=20038
ASBURY	67B	PRL 19 865	T.C. Bacon <i>et al.</i>	(BNL)	REFID=20039
BACON	67	PR 157 1263	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
EISNER	67	PR 164 1699	D.O. Huwe <i>et al.</i>	(COLU)	REFID=20049
HUWE	67	PL 24B 252	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20050
HYAMS	67	PL 24B 634	D.H. Miller <i>et al.</i>	(PURD)	REFID=20051
MILLER	67B	PR 153 1423	C. Alff-Steinberger <i>et al.</i>	(COLU, RUTG)	REFID=10762
ALFF...	66	PR 145 1072	T. Ferbel	(ROCH)	REFID=20028
FERBEL	66	PL 21 111	V. Hagopian <i>et al.</i>	(PENN, SACL)	REFID=20030
HAGOPIAN	66	PR 145 1128	V. Hagopian, Y.L. Pan	(PENN, LRL)	REFID=20031
HAGOPIAN	66B	PR 152 1183	L.D. Jacobs	(LRL)	REFID=20033
JACOBS	66B	UCRL 16877	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
JAMES	66	PR 142 896	M. Ross, L. Stodolsky		REFID=46380
ROSS	66	PR 149 1172	P. Soeding		REFID=46385
SOEDING	66	PL B19 702	E. West <i>et al.</i>	(WISC)	REFID=20035
WEST	66	PR 149 1089	H.R. Bliden <i>et al.</i>	(CERN MMS Collab.)	REFID=20016
BLIEDEN	65	PL 19 444	D.D. Carmony <i>et al.</i>	(UCB)	REFID=20578
CARMONY	64	PRL 12 254	G. Goldhaber <i>et al.</i>	(LRL, UCB)	REFID=20013
GOLDHABER	64	PRL 12 336	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006
ABOLINS	63	PRL 11 381			

$\omega(782)$

$$I^G(J^{PC}) = 0^-(1^--)$$

NODE=M001

 $\omega(782)$ MASS

NODE=M001M

NODE=M001M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
782.66±0.13 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
777.9 ±2.2 $^{+4.3}_{-2.2}$	900k	ANDREEV	20 H1	$e p \rightarrow e \pi^+ \pi^- p$
783.20±0.13±0.16	18680	AKHMETSHIN 05	CMD2	0.60-1.38 $e^+ e^- \rightarrow \pi^0 \gamma$
782.68±0.09±0.04	11200	¹ AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.79±0.08±0.09	1.2M	² ACHASOV 03D	RVUE	0.44-2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
781.96±0.17±0.80	11k	³ AMSLER 94C	CBAR	0.0 $\bar{p} p \rightarrow \omega \eta \pi^0$
782.08±0.36±0.82	3463	⁴ AMSLER 94C	CBAR	0.0 $\bar{p} p \rightarrow \omega \eta \pi^0$
781.96±0.13±0.17	15k	AMSLER 93B	CBAR	0.0 $\bar{p} p \rightarrow \omega \pi^0 \pi^0$
782.4 ±0.2	270k	WEIDENAUER 93	ASTE	$\bar{p} p \rightarrow 2\pi^+ 2\pi^- \pi^0$
782.4 ±0.5	7000	⁵ KEYNE 76	CNTR	$\pi^- p \rightarrow \omega n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
782.58±0.03±0.01		⁶ HOID 20	RVUE	$e^+ e^- \rightarrow \pi^0 \gamma$
781.68±0.09±0.03		⁷ COLANGELO 19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
782.63±0.03±0.01		⁸ HOFERICH... 19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
781.91±0.24		⁹ LEES 12G	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
782.7 ±0.1 ±1.5	19500	¹⁰ WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He} \omega$
781.78±0.10		¹⁰ BARKOV 87	CMD	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.2 ±0.4	1488	¹¹ KURDADZE 83B	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
783.3 ±0.4	433	CORDIER 80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
782.5 ±0.8	33260	ROOS 80	RVUE	0.0-3.6 $\bar{p} p$
782.6 ±0.8	3000	BENKHEIRI 79	OMEG	9-12 $\pi^\pm p$
781.8 ±0.6	1430	COOPER 78B	HBC	0.7-0.8 $\bar{p} p \rightarrow 5\pi$
782.7 ±0.9	535	VANAPEL... 78	HBC	7.2 $\bar{p} p \rightarrow \bar{p} p \omega$
783.5 ±0.8	2100	GESSAROLI 77	HBC	11 $\pi^- p \rightarrow \omega n$
782.5 ±0.8	418	AGUILAR-... 72B	HBC	3.9, 4.6 $K^- p$
783.4 ±1.0	248	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K^+ K^- \omega$
781.0 ±0.6	510	BIZZARRI 71	HBC	0.0 $p \bar{p} \rightarrow K_1 K_1 \omega$
783.7 ±1.0	3583	¹² COYNE 71	HBC	3.7 $\pi^+ p \rightarrow p \pi^+ \pi^+ \pi^- \pi^0$
784.1 ±1.2	750	ABRAMOVI... 70	HBC	3.9 $\pi^- p$
783.2 ±1.6		¹³ BIGGS 70B	CNTR	<4.1 $\gamma C \rightarrow \pi^+ \pi^- C$
782.4 ±0.5	2400	BIZZARRI 69	HBC	0.0 $\bar{p} p$

OCCUR=2

OCCUR=2

OCCUR=2

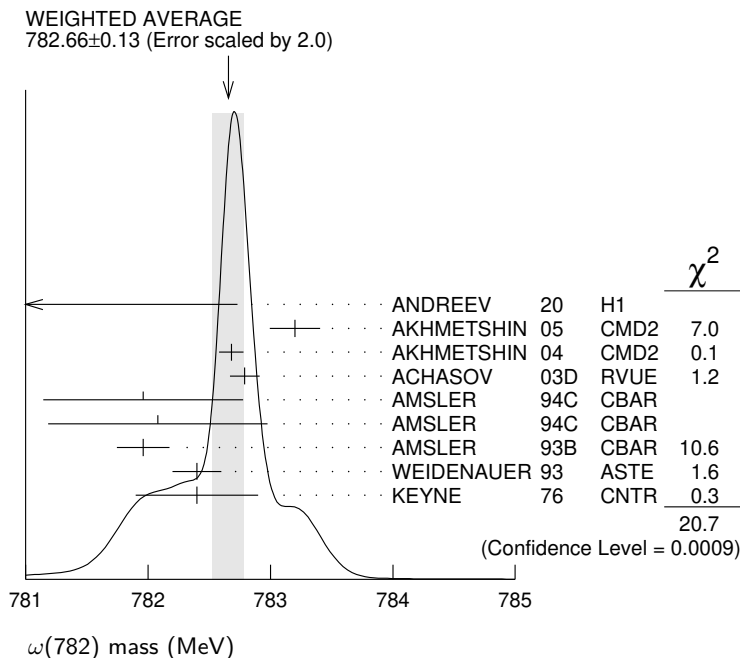
¹ Update of AKHMETSHIN 00C.² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega \pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.³ From the $\eta \rightarrow \gamma \gamma$ decay.⁴ From the $\eta \rightarrow 3\pi^0$ decay.⁵ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.⁶ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 782.736 ± 0.024 MeV.⁷ The ω mass was extracted from a dispersively improved Breit-Wigner parameterization, the ω width fixed at 8.49 ± 0.08 MeV. The value does not include vacuum polarization which would shift the mass to $781.81 \pm 0.09 \pm 0.03$ MeV. The mixing parameter is assumed real valued.⁸ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.⁹ From the $\rho - \omega$ interference in the $\pi^+ \pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.¹⁰ Systematic uncertainties underestimated.¹¹ Systematic uncertainties not estimated.¹² From best-resolution sample of COYNE 71.¹³ From $\omega - \rho$ interference in the $\pi^+ \pi^-$ mass spectrum assuming ω width 12.6 MeV.NODE=M001M;LINKAGE=PT
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NODE=M001M;LINKAGE=KB
NODE=M001M;LINKAGE=I
NODE=M001M;LINKAGE=D
NODE=M001M;LINKAGE=F



$\omega(782)$ WIDTH

NODE=M001W

NODE=M001W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
8.68±0.13 OUR AVERAGE				
8.68±0.23±0.10	11200	1 AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.68±0.04±0.15	1.2M	2 ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.65±0.06±0.01		3 HOID 20	RVUE	$e^+e^- \rightarrow \pi^0\gamma$
8.71±0.04±0.04		4 HOFERICH... 19	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.13±0.45		5 LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
8.2 ±0.3	19500	6 WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He}\omega$
8.4 ±0.1		7 AULCHENKO 87	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.30±0.40		6 BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.8 ±0.9	1488	8 KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0 ±0.8	433	6 CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
12 ±2	1430	COOPER 78B	HBC	0.7–0.8 $\bar{p}p \rightarrow 5\pi$
9.4 ±2.5	2100	GESSAROLI 77	HBC	11 $\pi^-p \rightarrow \omega n$
10.22±0.43	20000	9 KEYNE 76	CNTR	$\pi^-p \rightarrow \omega n$
13.3 ±2	418	AGUILAR... 72B	HBC	3.9,4.6 K^-p
9.1 ±0.8	451	6 BENAKSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
10.5 ±1.5		BORENSTEIN 72	HBC	2.18 K^-p
7.70±0.9 ±1.15	940	BROWN 72	MMS	2.5 $\pi^-p \rightarrow nMM$
10.3 ±1.4	510	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K_1 K_1 \omega$
12.8 ±3.0	248	BIZZARRI 71	HBC	0.0 $p\bar{p} \rightarrow K^+ K^- \omega$
9.5 ±1.0	3583	COYNE 71	HBC	3.7 $\pi^+p \rightarrow p\pi^+\pi^+\pi^-\pi^0$

OCCUR=2

¹ Update of AKHMETSHIN 00C.

² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

³ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 8.63 ± 0.05 MeV.

⁴ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.

⁵ From the $\rho-\omega$ interference in the $\pi^+\pi^-$ mass spectrum using the Breit-Wigner for the ω and leaving its mass and width as free parameters of the fit.

⁶ Systematic uncertainties underestimated.

⁷ Relativistic Breit-Wigner includes radiative corrections. Systematic uncertainties not estimated.

⁸ Systematic uncertainties not estimated.

⁹ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.

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NODE=M001W;LINKAGE=LE

NODE=M001W;LINKAGE=I
NODE=M001W;LINKAGE=G

NODE=M001W;LINKAGE=J
NODE=M001W;LINKAGE=B

$\omega(782)$ DECAY MODES

NODE=M001215;NODE=M001

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\pi^+\pi^-\pi^0$	(89.2 $\pm$ 0.7) %	
Γ_2 $\pi^0\gamma$	(8.35 $\pm$ 0.27) %	S=2.2
Γ_3 $\pi^+\pi^-$	(1.53 $\pm$ 0.12) %	S=1.2
Γ_4 neutrals (excluding $\pi^0\gamma$)	(7 $^{+8}_{-4}$) $\times 10^{-3}$	S=1.1
Γ_5 $\eta\gamma$	(4.5 $\pm$ 0.4) $\times 10^{-4}$	S=1.1
Γ_6 $\pi^0e^+e^-$	(7.7 $\pm$ 0.6) $\times 10^{-4}$	
Γ_7 $\pi^0\mu^+\mu^-$	(1.34 $\pm$ 0.18) $\times 10^{-4}$	S=1.5
Γ_8 ηe^+e^-		
Γ_9 e^+e^-	(7.38 $\pm$ 0.22) $\times 10^{-5}$	S=1.9
Γ_{10} $\pi^+\pi^-\pi^0\pi^0$	< 2 $\times 10^{-4}$	CL=90%
Γ_{11} $\pi^+\pi^-\gamma$	< 3.6 $\times 10^{-3}$	CL=95%
Γ_{12} $\pi^+\pi^-\pi^+\pi^-$	< 1 $\times 10^{-3}$	CL=90%
Γ_{13} $\pi^0\pi^0\gamma$	(6.7 $\pm$ 1.1) $\times 10^{-5}$	
Γ_{14} $\eta\pi^0\gamma$	< 3.3 $\times 10^{-5}$	CL=90%
Γ_{15} $\mu^+\mu^-$	(7.4 $\pm$ 1.8) $\times 10^{-5}$	
Γ_{16} 3γ	< 1.9 $\times 10^{-4}$	CL=95%

DESIG=1
DESIG=3
DESIG=2
DESIG=13
DESIG=6
DESIG=14
DESIG=11
DESIG=18
DESIG=7
DESIG=12
DESIG=4
DESIG=15
DESIG=5
DESIG=17
DESIG=8
DESIG=10

Charge conjugation (C) violating modes

Γ_{17} $\eta\pi^0$	C	< 2.1 $\times 10^{-4}$	CL=90%
Γ_{18} $2\pi^0$	C	< 2.2 $\times 10^{-4}$	CL=90%
Γ_{19} $3\pi^0$	C	< 2.3 $\times 10^{-4}$	CL=90%
Γ_{20} invisible		< 7 $\times 10^{-5}$	CL=90%

NODE=M001;CLUMP=A
DESIG=9
DESIG=193
DESIG=16
DESIG=194

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 48 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 48.0$ for 39 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	23								
x_3	-18	-4							
x_4	-92	-55	1						
x_5	7	23	-1	-15					
x_6	-1	0	0	0	0				
x_7	0	0	0	0	0	0			
x_9	-24	-73	4	47	-31	0	0		
x_{13}	1	4	0	-2	1	0	0	-3	
x_{15}	0	0	0	0	0	0	0	0	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_9	x_{13}

 $\omega(782)$ PARTIAL WIDTHS

NODE=M001218

 $\Gamma(\pi^0\gamma)$ **Γ_2**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
880 $\pm$ 50	7815	¹ ACHASOV	13	SND 1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
788 $\pm$ 12 $\pm$ 27	36500	² ACHASOV	03	SND 0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
764 $\pm$ 51	10625	DOLINSKY	89	ND $e^+e^- \rightarrow \pi^0\gamma$

¹ Systematic uncertainty not estimated.² Using $\Gamma_\omega = 8.44 \pm 0.09$ MeV and $B(\omega \rightarrow \pi^0\gamma)$ from ACHASOV 03.

NODE=M001W1
NODE=M001W1

NODE=M001W1;LINKAGE=AC
NODE=M001W1;LINKAGE=AD

$\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.1 ± 2.5 ¹ DOLINSKY 89 ND $e^+e^- \rightarrow \eta\gamma$

¹ Using $\Gamma_\omega = 8.4 \pm 0.1$ MeV and $B(\omega \rightarrow \eta\gamma)$ from DOLINSKY 89.

NODE=M001W2
NODE=M001W2

NODE=M001W2;LINKAGE=DA

 $\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.60 ± 0.02 OUR EVALUATION

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.591 ± 0.015 11200 ^{1,2} AKHMETSHIN 04 CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

0.653 ± 0.003 ± 0.021 1.2M ³ ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow$

0.600 ± 0.031 10625 DOLINSKY 89 ND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.891 \pm 0.007$ and $\Gamma_{\text{total}} = 8.44 \pm 0.09$ MeV.

² Update of AKHMETSHIN 00C.

³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

NODE=M001W7
NODE=M001W7

→ UNCHECKED ←

NODE=M001W7;LINKAGE=3P
NODE=M001W7;LINKAGE=PT
NODE=M001W;LINKAGE=VF

 $\omega(782) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$ $\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_9 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

569.8 ± 3.1 ± 8.2 ¹ LEES 21B BABR 10.5 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

¹ From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

NODE=M001235

NODE=M001R02
NODE=M001R02

NODE=M001R02;LINKAGE=A

 $\omega(782) \Gamma(e^+e^-) \Gamma(i) / \Gamma^2(\text{total})$ $\Gamma(e^+e^-) / \Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-\pi^0) / \Gamma_{\text{total}}$ $\Gamma_9 / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

6.59 ± 0.19 OUR FIT Error includes scale factor of 2.1.

6.36 ± 0.14 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

6.24 ± 0.11 ± 0.08 11.2k ¹ AKHMETSHIN 04 CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

6.74 ± 0.04 ± 0.24 1.2M ^{2,3} ACHASOV 03D RVUE 0.44–2.00 $e^+e^- \rightarrow$

6.37 ± 0.35 ² DOLINSKY 89 ND $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.20 ± 0.13 ⁴ BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

6.70 ± 0.06 ± 0.27 ⁵ AUBERT,B 04N BABR 10.6 $e^+e^- \rightarrow$

6.45 ± 0.24 ⁶ BARKOV 87 CMD $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

5.79 ± 0.42 1488 ⁷ KURDADZE 83B OLYA $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

5.89 ± 0.54 433 ⁶ CORDIER 80 DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

7.54 ± 0.84 451 ⁶ BENAKSAS 72B OSPK $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ Update of AKHMETSHIN 00C.

² Recalculated by us from the cross section in the peak.

³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

⁵ Superseded by LEES 21B.

⁶ Recalculated by us from the cross section in the peak. Systematic uncertainties underestimated.

⁷ Recalculated by us from the cross section in the peak. Systematic uncertainties not estimated.

NODE=M001225

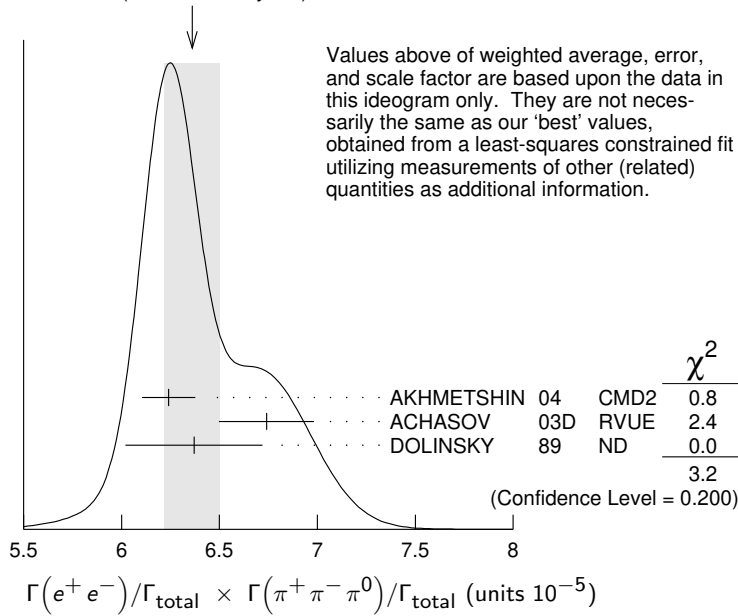
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NODE=M001G2;LINKAGE=B

WEIGHTED AVERAGE
6.36±0.14 (Error scaled by 1.3)



$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_2/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.16 ±0.14 OUR FIT	Error includes scale factor of 1.8.			
6.34 ±0.10 OUR AVERAGE				
6.336 ±0.056 ±0.089	1	ACHASOV 16A	SND	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.47 ±0.14 ±0.39	18k	AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
6.34 ±0.21 ±0.21	10k	2 DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.80 ±0.13	3	BENAYOUN 10	RVUE	0.4–1.05 e^+e^-
6.50 ±0.11 ±0.20	36k	4 ACHASOV 03	SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
¹ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 03. ² Recalculated by us from the cross section in the peak. ³ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data. ⁴ Using $\sigma(\phi \rightarrow \pi^0\gamma)$ from ACHASOV 00 and $m_\omega = 782.57$ MeV in the model with the energy-independent phase of ρ - ω interference equal to $(-10.2 \pm 7.0)^\circ$.				

NODE=M001G4
NODE=M001G4

NODE=M001G4;LINKAGE=A

NODE=M001G4;LINKAGE=LP
NODE=M001G4;LINKAGE=BE
NODE=M001G;LINKAGE=SH

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_3/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.28 ±0.05 OUR AVERAGE				
1.318 ±0.051 ±0.021	1	ACHASOV 21	SND	$e^+e^- \rightarrow \pi^+\pi^-$
1.225 ±0.058 ±0.041	800k	2 ACHASOV 06	SND	$e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.166 ±0.036	3	BENAYOUN 13	RVUE	0.4–1.05 e^+e^-
1.05 ±0.08	4	DAVIER 13	RVUE	$e^+e^- \rightarrow \pi^+\pi^-(\gamma)$
¹ From a fit of the cross section in the energy range $0.525 < \sqrt{s} < 0.883$ GeV parameterized by the sum of the Breit-Wigner amplitudes for the $\rho(770)$, ω and $\rho(1450)$ resonances. The measured phase of the $\rho(770)$ – ω interference is $(110.7 \pm 1.5 \pm 1.0)^\circ$. ² Supersedes ACHASOV 05A. ³ A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma, K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data. Supersedes BENAYOUN 10. ⁴ From $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$ data of LEES 12G.				

NODE=M001G5
NODE=M001G5

NODE=M001G5;LINKAGE=C

NODE=M001G5;LINKAGE=AC
NODE=M001G5;LINKAGE=B

NODE=M001G5;LINKAGE=A

$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}$

$\Gamma_9/\Gamma \times \Gamma_5/\Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
3.32 ±0.28 OUR FIT	Error includes scale factor of 1.1. $[(3.32 \pm 0.28) \times 10^{-8}]$ OUR 2023 FIT Scale factor = 1.1]			
3.18 ±0.28 OUR AVERAGE				
3.10 ±0.31 ±0.11	33k	1 ACHASOV 07B	SND	0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
3.17 ^{+1.85} _{-1.31} ±0.21	17.4k	2 AKHMETSHIN 05	CMD2	0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
3.41 ±0.52 ±0.21	23k	3,4 AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.50 ±0.10	5	BENAYOUN 10	RVUE	0.4–1.05 e^+e^-

NODE=M001G3
NODE=M001G3

NEW

- ¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.
- ² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.
- ³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.
- ⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).
- ⁵ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G3;LINKAGE=AH

NODE=M001G;LINKAGE=AH

NODE=M001G;LINKAGE=AK

NODE=M001G;LINKAGE=BQ

NODE=M001G3;LINKAGE=BE

NODE=M001G01

NODE=M001G01

NODE=M001G01;LINKAGE=A

$$\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\mu^+\mu^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_{15}/\Gamma$$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3±1.8±2.2	4.5M	¹ ANASTASI	17	KLOE $e^+e^- \rightarrow \mu^+\mu^-\gamma$

- ¹ From a fit of the real part of the vacuum polarization by a sum of the leptonic and hadronic contributions, where the hadronic contribution is parametrized as a sum of Breit-Wigner resonances $\omega(782)$, $\phi(1020)$ and using a GOUNARIS 68 parametrization for the $\rho(770)$, and a non-resonant term.

$\omega(782)$ BRANCHING RATIOS

NODE=M001220

$$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

NIECKNIG 12 describes final-state interactions between the three pions in a dispersive framework using data on the $\pi\pi$ P -wave scattering phase shift.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.9024±0.0019		¹ AMBROSINO	08G	KLOE	1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
0.8965±0.0016±0.0048	1.2M	^{2,3} ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.880 ±0.020 ±0.032	11200	^{3,4} AKHMETSHIN	00C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.8942±0.0062		³ DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

- ¹ Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.

- ² Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

- ³ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.

- ⁴ Using $\Gamma(e^+e^-) = 0.60 \pm 0.02$ keV.

NODE=M001R21;LINKAGE=AM

NODE=M001R;LINKAGE=VF

NODE=M001R;LINKAGE=ZL

NODE=M001R;LINKAGE=KH

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.88±0.18		¹ ACHASOV	16A	SND	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
8.09±0.14		² AMBROSINO	08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
9.06±0.20±0.57	18k	^{3,4} AKHMETSHIN	05	CMD2	0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$
9.34±0.15±0.31	36k	⁴ ACHASOV	03	SND	0.60–0.97 $e^+e^- \rightarrow \pi^0\gamma$
8.65±0.16±0.42	1.2M	^{5,6} ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.39±0.24	9k	⁷ BENAYOUN	96	RVUE	$e^+e^- \rightarrow \pi^0\gamma$
8.88±0.62	10k	⁴ DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$

- ¹ Using $B(\omega \rightarrow e^+e^-)$ from PDG 15. Supersedes ACHASOV 03.

- ² Not independent of $\Gamma(\pi^0\gamma) / \Gamma(\pi^+\pi^-\pi^0)$ from AMBROSINO 08G.

- ³ Using $B(\omega \rightarrow e^+e^-) = (7.14 \pm 0.13) \times 10^{-5}$.

- ⁴ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.

- ⁵ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+\pi^-) = (1.70 \pm 0.28)\%$.

- ⁶ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}^2$.

- ⁷ Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

NODE=M001R28;LINKAGE=A

NODE=M001R28;LINKAGE=AM

NODE=M001R;LINKAGE=AH

NODE=M001R;LINKAGE=VL

NODE=M001R28;LINKAGE=VF

NODE=M001R28;LINKAGE=ZL

NODE=M001R28;LINKAGE=A1

$$\Gamma(\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0) \quad \Gamma_2/\Gamma_1$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT

9.35±0.30 OUR FIT Error includes scale factor of 2.4.

9.05±0.27 OUR AVERAGE Error includes scale factor of 1.8.

8.97±0.16	AMBROSINO	08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
9.94±0.36±0.38	¹ AULCHENKO	00A	SND	$e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$
8.4 ±1.3	KEYNE	76	CNTR	$\pi^-p \rightarrow \omega n$
10.9 ±2.5	BENAKSAS	72C	OSPK	$e^+e^- \rightarrow \pi^0\gamma$
8.1 ±2.0	BALDIN	71	HLBC	$2.9 \pi^+p$
13 ±4	JACQUET	69B	HLBC	$2.05 \pi^+p \rightarrow \pi^+p\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.7 ±0.2 ±0.5	^{2,3} ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.9 ±0.7	² DOLINSKY	89	ND	$e^+e^- \rightarrow \pi^0\gamma$

NODE=M001R3

NODE=M001R3

¹ From $\sigma_0^{\omega\pi^0 \rightarrow \pi^0\pi^0\gamma}(m_\phi)/\sigma_0^{\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0\pi^0}(m_\phi)$ with a phase-space correction factor of 1/1.023.

² Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.

³ Using ACHASOV 03. Based on 1.2M events.

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

See also $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$.

Γ_3/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

1.53±0.12 OUR FIT Error includes scale factor of 1.2. $[(1.53^{+0.11}_{-0.13}) \times 10^{-2}]$ OUR 2023 FIT Scale factor = 1.2]

1.49±0.13 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

1.46±0.12±0.02	900k	¹ AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
1.30±0.24±0.05	11.2k	² AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
2.38 ^{+1.77} _{-0.90} ±0.18	5.4k	³ ACHASOV	02E	SND $1.1-1.38 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
2.3 ±0.5		BARKOV	85	OLYA $e^+e^- \rightarrow \pi^+\pi^-$
1.6 ^{+0.9} _{-0.7}		QUENZER	78	DM1 $e^+e^- \rightarrow \pi^+\pi^-$
3.6 ±1.9		BENAKSAS	72	OSPK $e^+e^- \rightarrow \pi^+\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.29±0.22±0.03	970k	^{4,5} ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$
1.28±0.22±0.03	970k	^{6,7} ABLIKIM	18C	BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$
1.52±0.08		⁸ HANHART	18	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
1.75±0.11	4.5M	⁹ ACHASOV	05A	SND $e^+e^- \rightarrow \pi^+\pi^-$
2.01±0.29		¹⁰ BENAYOUN	03	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
1.9 ±0.3		¹¹ GARDNER	99	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
2.3 ±0.4		¹² BENAYOUN	98	RVUE $e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
1.0 ±0.11		¹³ WICKLUND	78	ASPK $3,4,6 \pi^\pm N$
1.22±0.30		ALVENSLEB...	71C	CNTR Photoproduction
1.3 ^{+1.2} _{-0.9}		MOFFEIT	71	HBC $2.8,4.7 \gamma p$
0.80 ^{+0.28} _{-0.20}		¹⁴ BIGGS	70B	CNTR $4.2\gamma C \rightarrow \pi^+\pi^- C$

¹ A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

² Update of AKHMETSHIN 02.

³ From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.

⁴ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.

⁵ ABLIKIM 18C reports $[\Gamma(\omega(782) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \omega\gamma)] = (3.25 \pm 0.21 \pm 0.52) \times 10^{-4}$ which we divide by our best value $B(\eta'(958) \rightarrow \omega\gamma) = (2.52 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁶ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.

⁷ ABLIKIM 18C reports $[\Gamma(\omega(782) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \omega\gamma)] = (3.22 \pm 0.21 \pm 0.52) \times 10^{-4}$ which we divide by our best value $B(\eta'(958) \rightarrow \omega\gamma) = (2.52 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁸ Dispersive analysis. Value extracted from average of data from AUBERT 09AS, AKHMETSHIN 07, ACHASOV 06, AMBROSINO 11A, BABUSCI 13D, ABLIKIM 16B normalised by PDG 16 evaluation for $\Gamma(\omega \rightarrow e^+e^-)$.

⁹ Using $\Gamma(\omega \rightarrow e^+e^-)$ from the 2004 Edition of this Review (PDG 04).

¹⁰ Using the data of AKHMETSHIN 02 in the hidden local symmetry model.

¹¹ Using the data of BARKOV 85.

¹² Using the data of BARKOV 85 in the hidden local symmetry model.

¹³ From a model-dependent analysis assuming complete coherence.

¹⁴ Re-evaluated under $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ by BEHREND 71 using more accurate $\omega \rightarrow \rho$ photoproduction cross-section ratio.

NODE=M001R3;LINKAGE=AL

NODE=M001R3;LINKAGE=VL

NODE=M001R3;LINKAGE=VW

NODE=M001R15

NODE=M001R15

NODE=M001R15

NEW

OCCUR=3

OCCUR=2

NODE=M001R15;LINKAGE=AK

NODE=M001R15;LINKAGE=PT

NODE=M001R;LINKAGE=VE

NODE=M001R15;LINKAGE=E

NODE=M001R15;LINKAGE=H

NODE=M001R15;LINKAGE=J

NODE=M001R15;LINKAGE=K

NODE=M001R15;LINKAGE=D

NODE=M001R;LINKAGE=SN

NODE=M001R;LINKAGE=BY

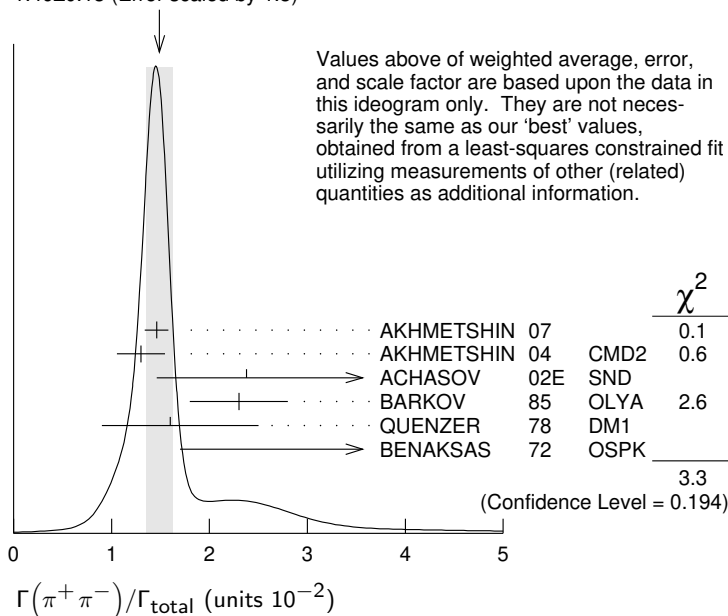
NODE=M001R15;LINKAGE=H4

NODE=M001R15;LINKAGE=Q

NODE=M001R15;LINKAGE=F

NODE=M001R15;LINKAGE=B

WEIGHTED AVERAGE
1.49±0.13 (Error scaled by 1.3)



$\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$

Γ_3/Γ_1

See also $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$.

VALUE	DOCUMENT ID	TECN	COMMENT
0.0172±0.0014 OUR FIT	Error includes scale factor of 1.2.		
0.026 ±0.005 OUR AVERAGE			

0.021 +0.028 -0.009	1,2	RATCLIFF	72	ASPK	15 $\pi^- p \rightarrow n 2\pi$
0.028 ±0.006	1	BEHREND	71	ASPK	Photoproduction
0.022 +0.009 -0.01	3	ROOS	70	RVUE	

¹ The fitted width of these data is 160 MeV in agreement with present average, thus the ω contribution is overestimated. Assuming ρ width 145 MeV.

² Significant interference effect observed. NB of $\omega \rightarrow 3\pi$ comes from an extrapolation.

³ ROOS 70 combines ABRAMOVICH 70 and BIZZARRI 70.

NODE=M001R2

NODE=M001R2

NODE=M001R2

NODE=M001R2;LINKAGE=A

NODE=M001R2;LINKAGE=S

NODE=M001R2;LINKAGE=R

$\Gamma(\pi^+\pi^-)/\Gamma(\pi^0\gamma)$

Γ_3/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.20±0.04	1.98M	¹ ALOISIO	03	KLOE

1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$

¹ Using the data of ALOISIO 02D.

NODE=M001R33

NODE=M001R33

NODE=M001R;LINKAGE=KL

$\Gamma(\text{neutrals})/\Gamma_{\text{total}}$

$(\Gamma_2+\Gamma_4)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.091±0.006 OUR FIT				
0.081±0.011 OUR AVERAGE				

0.075±0.025		BIZZARRI	71	HBC	0.0 $p\bar{p}$
0.079±0.019		DEINET	69B	OSPK	1.5 $\pi^- p$
0.084±0.015		BOLLINI	68C	CNTR	2.1 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.073±0.018	42	BASILE	72B	CNTR	1.67 $\pi^- p$

NODE=M001R14

NODE=M001R14

$\Gamma(\text{neutrals})/\Gamma(\pi^+\pi^-\pi^0)$

$(\Gamma_2+\Gamma_4)/\Gamma_1$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.102±0.008 OUR FIT				
0.103^{+0.011}_{-0.010} OUR AVERAGE				

0.15 ±0.04	46	AGUILAR-...	72B	HBC	3.9,4.6 $K^- p$
0.10 ±0.03	19	BARASH	67B	HBC	0.0 $\bar{p}p$
0.134±0.026	850	DIGIUGNO	66B	CNTR	1.4 $\pi^- p$
0.097±0.016	348	FLATTE	66	HBC	1.4 – 1.7 $K^- p \rightarrow \Lambda MM$
0.06 +0.05 -0.02		JAMES	66	HBC	2.1 $\pi^+ p$
0.08 ±0.03	35	KRAEMER	64	DBC	1.2 $\pi^+ d$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.11 ±0.02	20	BUSCHBECK	63	HBC	1.5 $K^- p$

NODE=M001R1

NODE=M001R1

$\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$ $\Gamma_2/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.78 ± 0.07		¹ DAKIN	72	OSPK	$1.4 \pi^- p \rightarrow n \text{MM}$
>0.81	90	DEINET	69B	OSPK	

¹ Error statistical only. Authors obtain good fit also assuming $\pi^0\gamma$ as the only neutral decay.

NODE=M001R18
NODE=M001R18

NODE=M001R18;LINKAGE=D

 $\Gamma(\text{neutrals})/\Gamma(\text{charged particles})$ $(\Gamma_2+\Gamma_4)/(\Gamma_1+\Gamma_3)$

VALUE	DOCUMENT ID	TECN	COMMENT

0.100 ± 0.008 OUR FIT

0.124 ± 0.021

FELDMAN 67C OSPK $1.2 \pi^- p$

NODE=M001R9
NODE=M001R9

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

4.5 ± 0.4 OUR FIT Error includes scale factor of 1.1. $[(4.5 \pm 0.4) \times 10^{-4} \text{ OUR 2023 FIT Scale factor} = 1.1]$

6.3 ± 1.3 OUR AVERAGE Error includes scale factor of 1.2.

6.6 ± 1.7		¹ ABELE	97E	CBAR	$0.0 \bar{p} p \rightarrow 5\gamma$
8.3 ± 2.1		ALDE	93	GAM2	$38\pi^- p \rightarrow \omega n$
$3.0^{+2.5}_{-1.8}$		² ANDREWS	77	CNTR	$6.7\text{--}10 \gamma \text{Cu}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.2 \pm 0.4 \pm 0.1$	33k	³ ACHASOV	07B	SND	$0.6\text{--}1.38 e^+ e^- \rightarrow \eta\gamma$
$4.44^{+2.59}_{-1.83} \pm 0.28$	17.4k	^{4,5} AKHMETSHIN	05	CMD2	$0.60\text{--}1.38 e^+ e^- \rightarrow \eta\gamma$
$5.10 \pm 0.72 \pm 0.34$	23k	⁶ AKHMETSHIN	01B	CMD2	$e^+ e^- \rightarrow \eta\gamma$
$0.7 \text{ to } 5.5$		⁷ CASE	00	CBAR	$0.0 p\bar{p} \rightarrow \eta\eta\gamma$
$6.56^{+2.41}_{-2.55}$	3525	^{2,8} BENAYOUN	96	RVUE	$e^+ e^- \rightarrow \eta\gamma$
7.3 ± 2.9		^{2,4} DOLINSKY	89	ND	$e^+ e^- \rightarrow \eta\gamma$

¹ No flat $\eta\eta\gamma$ background assumed.

² Solution corresponding to constructive $\omega\rho$ interference.

³ ACHASOV 07B reports $[\Gamma(\omega(782) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow e^+ e^-)] = (3.10 \pm 0.31 \pm 0.11) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow e^+ e^-) = (7.38 \pm 0.22) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

⁴ Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.

⁵ Using $B(\omega \rightarrow e^+ e^-) = (7.14 \pm 0.13) \times 10^{-5}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

⁶ Using $B(\omega \rightarrow e^+ e^-) = (7.07 \pm 0.19) \times 10^{-5}$ and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$. Solution corresponding to constructive $\omega\rho$ interference. The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively). Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.

⁷ Depending on the degree of coherence with the flat $\eta\eta\gamma$ background and using $B(\omega \rightarrow \pi^0\gamma) = (8.5 \pm 0.5) \times 10^{-2}$.

⁸ Reanalysis of DRUZHININ 84, DOLINSKY 89, DOLINSKY 91 taking into account the triangle anomaly contributions.

NODE=M001R19
NODE=M001R19

NEW

NODE=M001R;LINKAGE=EA
NODE=M001R19;LINKAGE=A
NODE=M001R19;LINKAGE=AO

NODE=M001R13;LINKAGE=WL
NODE=M001R19;LINKAGE=AK
NODE=M001R19;LINKAGE=TS

NODE=M001R;LINKAGE=CS

NODE=M001R19;LINKAGE=A1

 $\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0098 ± 0.0024	¹ ALDE	93	GAM2	$38\pi^- p \rightarrow \omega n$
0.0082 ± 0.0033	² DOLINSKY	89	ND	$e^+ e^- \rightarrow \eta\gamma$
0.010 ± 0.045	APEL	72B	OSPK	$4\text{--}8 \pi^- p \rightarrow n 3\gamma$

¹ Model independent determination.

² Solution corresponding to constructive $\omega\rho$ interference.

NODE=M001R11
NODE=M001R11

NODE=M001R11;LINKAGE=A
NODE=M001R11;LINKAGE=K

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

7.7 ± 0.6 OUR FIT

7.7 ± 0.6 OUR AVERAGE

$7.61 \pm 0.53 \pm 0.64$		ACHASOV	08	SND	$0.36\text{--}0.97 e^+ e^- \rightarrow \pi^0 e^+ e^-$
$8.19 \pm 0.71 \pm 0.62$		AKHMETSHIN	05A	CMD2	$0.72\text{--}0.84 e^+ e^-$
5.9 ± 1.9	43	DOLINSKY	88	ND	$e^+ e^- \rightarrow \pi^0 e^+ e^-$

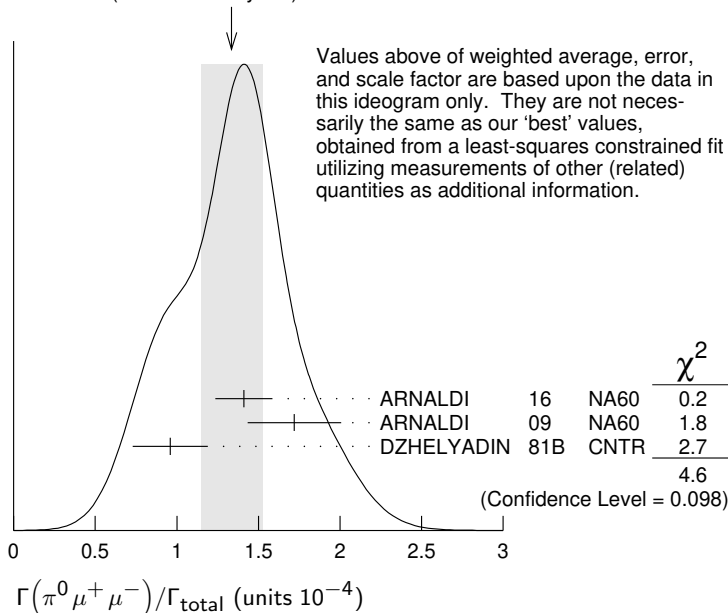
NODE=M001R23
NODE=M001R23

$\Gamma(\pi^0 \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVS	DOCUMENT ID	TECN	COMMENT

1.34±0.18 OUR FIT Error includes scale factor of 1.5.**1.34±0.19 OUR AVERAGE** Error includes scale factor of 1.5. See the ideogram below.

1.41±0.09±0.15		ARNALDI	16	NA60	400 GeV (p -A) collisions
1.72±0.25±0.14	3k	ARNALDI	09	NA60	158A In-In collisions
0.96±0.23		DZHELYADIN	81B	CNTR	25-33 $\pi^- p \rightarrow \omega n$

WEIGHTED AVERAGE
1.34±0.19 (Error scaled by 1.5) $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.1 AKHMETSHIN 05A CMD2 0.72-0.84 $e^+ e^-$ $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVS	DOCUMENT ID	TECN	COMMENT

0.738±0.022 OUR FIT Error includes scale factor of 1.9.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.700±0.016	11200	1,2 AKHMETSHIN 04	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.752±0.004±0.024	1.2M	2,3 ACHASOV 03D	RVUE	0.44-2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.714±0.036		2 DOLINSKY 89	ND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.72 ±0.03		2 BARKOV 87	CMD	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.64 ±0.04	1488	2 KURDADZE 83B	OLYA	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.675±0.069	433	2 CORDIER 80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.83 ±0.10	451	2 BENAKSAS 72B	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.77 ±0.06		4 AUGUSTIN 69D	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.65 ±0.13	33	5 ASTVACAT... 68	OSPK	Assume SU(3)+mixing

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = 0.891 \pm 0.007$. Update of AKHMETSHIN 00C.² Not independent of the corresponding $\Gamma(e^+ e^-) \times \Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}^2$.³ Using ACHASOV 03, ACHASOV 03D and $B(\omega \rightarrow \pi^+ \pi^-) = (1.70 \pm 0.28)\%$.⁴ Rescaled by us to correspond to ω width 8.4 MeV. Systematic errors underestimated.⁵ Not resolved from ρ decay. Error statistical only. $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 2 90 ACHASOV 09A SND $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<200 90 KURDADZE 86 OLYA $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$ NODE=M001R12
NODE=M001R12NODE=M001R34
NODE=M001R34NODE=M001R13
NODE=M001R13NODE=M001R13;LINKAGE=4P
NODE=M001R13;LINKAGE=ZL
NODE=M001R13;LINKAGE=VF
NODE=M001R13;LINKAGE=E
NODE=M001R13;LINKAGE=ANODE=M001R5
NODE=M001R5

$\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$
 Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	95	WEIDENAUER 90	ASTE	$p\bar{p} \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.004	95	BITYUKOV 88B	SPEC	$32 \pi^-\rho \rightarrow \pi^+\pi^-\gamma X$

NODE=M001R22
NODE=M001R22

 $\Gamma(\pi^+\pi^-\gamma)/\Gamma(\pi^+\pi^-\pi^0)$
 Γ_{11}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.066	90	KALBFLEISCH 75	HBC	$2.18 K^-\rho \rightarrow \Lambda\pi^+\pi^-\gamma$
<0.05	90	FLATTE 66	HBC	$1.2 - 1.7 K^-\rho \rightarrow \Lambda\pi^+\pi^-\gamma$

NODE=M001R4
NODE=M001R4

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1 × 10⁻³	90	KURDADZE 88	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

NODE=M001R24
NODE=M001R24

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$
 Γ_{13}/Γ

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±1.1 OUR FIT				
6.5±1.2 OUR AVERAGE				
$6.4^{+2.4}_{-2.0} \pm 0.8$	190	¹ AKHMETSHIN 04B	CMD2	$0.6-0.97 e^+e^- \rightarrow \pi^0\pi^0\gamma$
$6.6^{+1.4}_{-1.3} \pm 0.6$	295	ACHASOV 02F	SND	$0.36-0.97 e^+e^- \rightarrow \pi^0\pi^0\gamma$

NODE=M001R29
NODE=M001R29

• • • We do not use the following data for averages, fits, limits, etc. • • •

$11.8^{+2.1}_{-1.9} \pm 1.4$	190	² AKHMETSHIN 04B	CMD2	$0.6-0.97 e^+e^- \rightarrow \pi^0\pi^0\gamma$
$7.8 \pm 2.7 \pm 2.0$	63	^{1,3} ACHASOV 00G	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$12.7 \pm 2.3 \pm 2.5$	63	^{2,3} ACHASOV 00G	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=2

OCCUR=2

¹ In the model assuming the $\rho \rightarrow \pi^0\pi^0\gamma$ decay via the $\omega\pi$ and $f_0(500)\gamma$ mechanisms.

² In the model assuming the $\rho \rightarrow \pi^0\pi^0\gamma$ decay via the $\omega\pi$ mechanism only.

³ Superseded by ACHASOV 02F.

NODE=M001R29;LINKAGE=A
NODE=M001R29;LINKAGE=B
NODE=M001R;LINKAGE=GF

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$
 Γ_{13}/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.00045	90	DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.08	95	JACQUET 69B	HLBC	$2.05 \pi^+p \rightarrow \pi^+p\omega$

NODE=M001R10
NODE=M001R10

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\pi^0\gamma)$
 Γ_{13}/Γ_2

VALUE (units 10 ⁻⁴)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±1.3 OUR FIT					
8.5±2.9					
	40 ± 14	ALDE 94B	GAM2		$38\pi^-\rho \rightarrow \pi^0\pi^0\gamma n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 50	90	DOLINSKY 89	ND		$e^+e^- \rightarrow \pi^0\pi^0\gamma$
<1800	95	KEYNE 76	CNTR		$\pi^-\rho \rightarrow \omega n$
<1500	90	BENAKSAS 72C	OSPK		e^+e^-
<1400		BALDIN 71	HLBC		$2.9 \pi^+p$
<1000	90	BARMIN 64	HLBC		$1.3-2.8 \pi^-\rho$

NODE=M001R7
NODE=M001R7

 $\Gamma(\pi^0\pi^0\gamma)/\Gamma(\text{neutrals})$
 $\Gamma_{13}/(\Gamma_2+\Gamma_4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.22 ± 0.07		¹ DAKIN 72	OSPK	$1.4 \pi^-\rho \rightarrow nMM$
<0.19	90	DEINET 69B	OSPK	

¹ See $\Gamma(\pi^0\gamma)/\Gamma(\text{neutrals})$.

NODE=M001R17
NODE=M001R17

NODE=M001R17;LINKAGE=D

 $\Gamma(\eta\pi^0\gamma)/\Gamma_{\text{total}}$
 Γ_{14}/Γ

VALUE (units 10 ⁻⁵)	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	AKHMETSHIN 04B	CMD2	$0.6-0.97 e^+e^- \rightarrow \eta\pi^0\gamma$

NODE=M001R32
NODE=M001R32

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

7.4±1.8 OUR FIT**7.4±1.8 OUR AVERAGE**

6.6±1.4±1.7	4.5M	¹ ANASTASI	17	KLOE	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
9.0±2.9±1.1	18	HEISTER	02C	ALEP	$Z \rightarrow \mu^+\mu^- + X$

¹ Assuming lepton universality in the decay $\omega \rightarrow \ell^+ \ell^-$ and correcting for different phase space between electron and muon final states.

NODE=M001R30
NODE=M001R30

NODE=M001R30;LINKAGE=A

 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{15}/Γ_1 VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<0.2	90	WILSON	69	OSPK	$12 \pi^- C \rightarrow \text{Fe}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.7	74	FLATTE	66	HBC	$1.2 - 1.7 K^- p \rightarrow \Lambda \mu^+ \mu^-$
<1.2		BARBARO-...	65	HBC	$2.7 K^- p$

NODE=M001R6
NODE=M001R6

 $\Gamma(\pi^0\mu^+\mu^-)/\Gamma(\mu^+\mu^-)$ Γ_7/Γ_{15}

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.2±0.6	30	¹ DZHELYADIN	79	CNTR	$25-33 \pi^- p$

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20
NODE=M001R20

NODE=M001R20;LINKAGE=S

 $\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<1.9	95	¹ ABELE	97E	CBAR	$0.0 \bar{p} p \rightarrow 5\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2	90	¹ PROKOSHKIN	95	GAM2	$38 \pi^- p \rightarrow 3\gamma n$

¹ From direct 3γ decay search.

NODE=M001R27
NODE=M001R27

NODE=M001R27;LINKAGE=A

 $\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

Violates C conservation.

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.001	90	ALDE	94B	GAM2	$38\pi^- p \rightarrow \eta\pi^0 n$

 $[\Gamma(\eta\gamma) + \Gamma(\eta\pi^0)]/\Gamma(\pi^+\pi^-\pi^0)$ $(\Gamma_5 + \Gamma_{17})/\Gamma_1$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.016	90	¹ FLATTE	66	HBC	$1.2 - 1.7 K^- p \rightarrow \Lambda \pi^+ \pi^- \text{MM}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.045	95	JACQUET	69B	HLBC	$2.05 \pi^+ p \rightarrow \pi^+ p \omega$

¹ Restated by us using $B(\eta \rightarrow \text{charged modes}) = 29.2\%$.

NODE=M001R8
NODE=M001R8

NODE=M001R8;LINKAGE=A

 $\Gamma(\eta\pi^0)/\Gamma(\pi^0\gamma)$ Γ_{17}/Γ_2

Violates C conservation.

VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<2.6	90	¹ STAROSTIN	09	CRYM	$\gamma p \rightarrow \eta\pi^0 p$

¹ STAROSTIN 09 reports $[\Gamma(\omega(782) \rightarrow \eta\pi^0)/\Gamma(\omega(782) \rightarrow \pi^0\gamma)] \times [B(\eta \rightarrow 2\gamma)] < 1.01 \times 10^{-3}$ which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M001R35
NODE=M001R35
NODE=M001R35

NODE=M001R35;LINKAGE=ST

 $\Gamma(2\pi^0)/\Gamma(\pi^0\gamma)$ Γ_{18}/Γ_2

Violates C conservation and Bose-Einstein statistics.

VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<2.59	90	STAROSTIN	09	CRYM	$\gamma p \rightarrow 2\pi^0 p$

NODE=M001R36
NODE=M001R36
NODE=M001R36

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

Violates C conservation.

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3×10^{-4}	90	PROKOSHKIN	95	GAM2	$38 \pi^- p \rightarrow 3\pi^0 n$

NODE=M001R26
NODE=M001R26
NODE=M001R26

$\Gamma(3\pi^0)/\Gamma(\pi^0\gamma)$ Violates C conservation.

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.72	90	STAROSTIN	09	CRYM $\gamma p \rightarrow 3\pi^0 p$

 Γ_{19}/Γ_2

NODE=M001R37
 NODE=M001R37
 NODE=M001R37

 $\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Violates C conservation.

VALUE	CL%	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.009	90	BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$

 Γ_{19}/Γ_1

NODE=M001R31
 NODE=M001R31
 NODE=M001R31

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\pi^0)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.1 $\times 10^{-5}$	90	ABLIKIM	18S	BES3 $J/\psi \rightarrow \omega\eta \rightarrow \omega\pi^+\pi^-\pi^0$

 Γ_{20}/Γ_1

NODE=M001R01
 NODE=M001R01

PARAMETER Λ IN $\omega \rightarrow \pi^0 \ell^+ \ell^-$ DECAY

NODE=M001230

In the pole approximation the electromagnetic transition form factor for a resonance of mass M is given by the expression:

$$|F|^2 = (1 - M^2/\Lambda^2)^{-2},$$

where for the parameter Λ vector dominance predicts $\Lambda = M_p \approx 0.770$ GeV. The ARNALDI 09 measurement is in obvious conflict with this expectation. Note that for $\eta \rightarrow \gamma\mu^+\mu^-$ decay ARNALDI 09 and DZHELYADIN 80 obtain the value of Λ consistent with vector dominance.

NODE=M001230

PARAMETER Λ IN $\omega \rightarrow \pi^0 \mu^+ \mu^-$ DECAY

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.670 ± 0.006 OUR AVERAGE				
0.6707 $\pm 0.0039 \pm 0.0056$		¹ ARNALDI	16	NA60 400 GeV (p -A) collisions
0.668 $\pm 0.009 \pm 0.003$	3k	² ARNALDI	09	NA60 158A In-In collisions
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.65 ± 0.03		DZHELYADIN	81B	CNTR 25-33 $\pi^- p \rightarrow \omega n$
¹ ARNALDI 16 reports $\Lambda^{-2}(\omega) = 2.223 \pm 0.026 \pm 0.037$ GeV $^{-2}$ which we converted to the quoted Λ value.				
² ARNALDI 09 reports $\Lambda^{-2}(\omega) = 2.24 \pm 0.06 \pm 0.02$ GeV $^{-2}$ which we converted to the quoted Λ value.				

NODE=M001LAM
 NODE=M001LAM

NODE=M001LAM;LINKAGE=A

NODE=M001LAM;LINKAGE=B

PARAMETER Λ IN $\omega \rightarrow \pi^0 e^+ e^-$ DECAY

VALUE (GeV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.709 ± 0.037	1.1k	¹ ADLARSON	17B	A2MM $\gamma p \rightarrow \omega p$
¹ ADLARSON 17B reports $\Lambda^{-2}(\omega\pi^0) = 1.99 \pm 0.21$ GeV $^{-2}$ that we converted to the quoted Λ value.				

NODE=M001A02
 NODE=M001A02

NODE=M001A02;LINKAGE=A

ENERGY DEPENDENCE OF $\omega \rightarrow \pi^+\pi^-\pi^0$ DALITZ PLOT

The following experiments fit to one or more of the coefficients α, β, γ for $|\text{matrix element}|^2 \propto P(1 + 2\alpha Z + 2\beta Z^{3/2} \sin(3\phi) + 2\gamma Z^2 + O(Z^{5/2}))$ where P is the P -wave phase-space factor and Z, ϕ are kinematical variables as defined in ADLARSON 17.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.133 ± 0.008 OUR AVERAGE				
0.1321 $\pm 0.0067 \pm 0.0046$	260k	¹ ABLIKIM	18AD	BES3 $J/\psi \rightarrow \omega\eta$
0.147 ± 0.036	44k	ADLARSON	17	WASA α in $pd \rightarrow {}^3\text{He } \omega$, $pp \rightarrow pp\omega$

NODE=M001A00

¹ Keeping a term linear in Z only. A fit with the terms proportional to Z and $Z^{3/2}$ gives $\alpha = 0.133 \pm 0.041$ and $\beta = 0.037 \pm 0.054$.

NODE=M001A00;LINKAGE=A

$\omega(782)$ REFERENCES

NODE=M001

ACHASOV	21	JHEP 2101 113	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61040
LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
ANDREEV	20	EPJ C80 1189	V. Andreev <i>et al.</i>	(H1 Collab.)	REFID=60773
HOID	20	EPJ C80 988	B.-L. Hoid, M. Hoferichter, B. Kubis	(BONN, BERN)	REFID=61048
COLANGELO	19	JHEP 1902 006	G. Colangelo, M. Hoferichter, P. Stoffer	(BERN+)	REFID=59585
HOERICHT...	19	JHEP 1908 137	M. Hoferichter, B.-L. Hoid, B. Kubis	(WASH, BONN)	REFID=60974
ABLIKIM	18AD	PR D98 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59498
ABLIKIM	18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ABLIKIM	18S	PR D98 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58971
HANHART	18	EPJ C78 450	C. Hanhart <i>et al.</i>		REFID=59186
ADLARSON	17	PL B770 418	P. Adlarson <i>et al.</i>	(WASA-at-COSY Collab.)	REFID=57907
ADLARSON	17B	PR C95 035208	P. Adlarson <i>et al.</i>	(A2 Collab. at MAMI)	REFID=58155
ANASTASI	17	PL B767 485	A. Anastasi <i>et al.</i>	(KLOE-2 Collab.)	REFID=57887
ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57126
ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57513
ARNALDI	16	PL B757 437	R. Arnaldi <i>et al.</i>	(NA60 Collab.)	REFID=57220
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977; ERROR=4
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
BABUSCI	13D	PL B720 336	D. Babusci <i>et al.</i>	(CATA, CALB, BARI)	REFID=55337
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono (PARIN, BERLIN+)		REFID=55357
DAVIER	13	EPJ C73 2597	M. Davier <i>et al.</i>		REFID=55499
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)	REFID=54305
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>		REFID=53212
ACHASOV	09A	JETP 109 379	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=53101
		Translated from ZETF 136 442.			
ARNALDI	09	PL B677 260	R. Arnaldi <i>et al.</i>	(NA60 Collab.)	REFID=52720
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
STAROSTIN	09	PR C79 065201	A. Starostin <i>et al.</i>	(Crystal Ball Collab. at MAMI)	REFID=53001
ACHASOV	08	JETP 107 61	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=52258
		Translated from ZETF 134 80.			
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=52573
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AULCHENKO	06	JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
		Translated from ZETFP 84 491.			
ACHASOV	05A	JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
		Translated from ZETF 128 1201.			
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AKHMETSHIN	05A	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
AULCHENKO	05	JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
		Translated from ZETFP 82 841.			
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AKHMETSHIN	04B	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
BENAYOUN	03	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
ACHASOV	02F	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
AKHMETSHIN	02	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
HEISTER	02C	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00G	JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
		Translated from ZETFP 71 519.			
AKHMETSHIN	00C	PL B476 33	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
CASE	00	PR D61 032002	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
GARDNER	99	PR D59 076002	S. Gardner, H.B. O'Connell		REFID=46919
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
ABELE	97E	PL B411 361	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
PROKOSHKIN	95	PD 40 273	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
		Translated from DANS 342 610.			
WURZINGER	95	PR C51 443	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
ALDE	94B	PL B340 122	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44100
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
ALDE	93	PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
		Translated from YAF 56 137.			
Also		ZPHY C61 35	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
WEIDENAUER	90	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BITYUKOV	88B	SJNP 47 800	S.I. Bityukov <i>et al.</i>	(SERP)	REFID=41021
		Translated from YAF 47 1258.			
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
		Translated from YAF 48 442.			
KURDADZE	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
		Translated from ZETFP 47 432.			
AULCHENKO	87	PL B186 432	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40007
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
		Translated from ZETFP 46 132.			

KURDADZE	86	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BARKOV	85	Translated from ZETFP 43 497.	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
DRUZHININ	84	NP B256 365	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
KURDADZE	83B	PL 144B 136	A.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20244
DZHELYADIN	81B	JETPL 36 274	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20242
CORDIER	80	Translated from ZETFP 36 221.	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
DZHELYADIN	80	PL 102B 296	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=10831
ROOS	80	NP B172 13	M. Roos, A. Pellinen	(HELS)	REFID=20241
BENKHEIRI	79	PL 94B 548	P. Benkheiri <i>et al.</i>	(EPOL, CERN, CDEF+)	REFID=20238
DZHELYADIN	79	LNC 27 321	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20239
COOPER	78B	NP B150 268	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
QUENZER	78	PL 84B 143	A. Quenzer <i>et al.</i>	(LALO)	REFID=20123
VANAPEL...	78	NP B146 1	G.W. van Apeldoorn <i>et al.</i>	(ZEEM)	REFID=20234
WICKLUND	78	PL 76B 512	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
ANDREWS	77	PR D17 1197	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
GESSAROLI	77	PRL 38 198	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
KEYNE	76	NP B126 382	J. Keyne <i>et al.</i>	(LOIC, SHMP)	REFID=20226
Also		PR D14 28	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
KALBFLEISCH	75	PR D8 2789	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AGUILAR-...	72B	PR D11 987	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72B	PR D6 29	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20206
BASILE	72B	PL 41B 234	M. Basile <i>et al.</i>	(CERN)	REFID=20207
BENAKSAS	72	Phil. Conf. 153	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72B	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20209
BENAKSAS	72C	PL 42B 507	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20517
BORENSTEIN	72	PL 42B 511	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
BROWN	72	PR D5 1559	R.M. Brown <i>et al.</i>	(ILL, ILLC)	REFID=20211
DAKIN	72	PL 42B 117	J.T. Dakin <i>et al.</i>	(PRIN)	REFID=20212
RATCLIFF	72	PR D6 2321	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
ALVENSELEB...	71C	PL 38B 345	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20193
BALDIN	71	PRL 27 888	A.B. Baldin <i>et al.</i>	(ITEP)	REFID=20195
BEHREND	71	SJNP 13 758	H.J. Behrend <i>et al.</i>	(ROCH, CORN, FNAL)	REFID=20197
BIZZARRI	71	Translated from YAF 13 1318.	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20198
COYNE	71	PRL 27 61	D.G. Coyne <i>et al.</i>	(LRL)	REFID=20201
MOFFEIT	71	NP B27 140	K.C. Moffeit <i>et al.</i>	(LRL, UCB, SLAC+)	REFID=20204
ABRAMOVI...	70	NP B32 333	M. Abramovich <i>et al.</i>	(CERN)	REFID=20180
BIGGS	70B	NP B29 349	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20184
BIZZARRI	70	NP B20 209	R. Bizzarri <i>et al.</i>	(ROMA, SYRA)	REFID=20181
ROOS	70	PRL 24 1201	M. Roos	(CERN)	REFID=20191
Also		PRL 25 1385			
Proc. Daresbury Study Weekend No. 1.		DNPL/R7 173			
AUGUSTIN	69D	PL 28B 513	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=20169
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
DEINET	69B	NP B14 169	W. Deinet <i>et al.</i>	(KARL, CERN)	REFID=20173
JACQUET	69B	PL 30B 426	F. Jacquet <i>et al.</i>	(EPOL, BERG)	REFID=20176
WILSON	69	NC 63A 743	R. Wilson	(HARV)	REFID=20179
Also		Private Comm.	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
ASTVACAT...	68	PR 178 2095	R.G. Astvatsaturov <i>et al.</i>	(JINR, MOSU)	REFID=20055
BOLLINI	68C	PL 27B 45	D. Bollini <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20164
GOUNARIS	68	NC 56A 531	G.J. Gounaris, J.J. Sakurai		REFID=48054
BARASH	67B	PRL 21 244	N. Barash <i>et al.</i>	(COLU)	REFID=20160
FELDMAN	67C	PR 156 1399	M. Feldman <i>et al.</i>	(PENN)	REFID=20161
DIGIUGNO	66B	PR 159 1219	G. Di Giugno <i>et al.</i>	(NAPL, FRAS, TRST)	REFID=20156
FLATTE	66	NC 44A 1272	S.M. Flatte <i>et al.</i>	(LRL)	REFID=20157
JAMES	66	PR 145 1050	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
BARBARO...	65	PR 142 896	A. Barbaro-Galtieri, R.D. Tripp	(LRL)	REFID=20152
BARMIN	64	PRL 14 279	V.V. Barmin <i>et al.</i>	(ITEP)	REFID=20149
KRAEMER	64	JETP 18 1289	R.W. Kraemer <i>et al.</i>	(JHU, NWES, WOOD)	REFID=10755
BUSCHBECK	63	Translated from ZETF 45 1879.	B. Buschbeck <i>et al.</i>	(VIEN, CERN, ANIK)	REFID=20146
		PR 136 B496			
		Siena Conf. 1 166			

$\eta'(958)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

NODE=M002

 $\eta'(958)$ MASS

NODE=M002M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
957.78 ±0.06 OUR AVERAGE				
957.793±0.054±0.036	3.9k	LIBBY	08	CLEO $J/\psi \rightarrow \gamma\eta'$
957.9 ±0.2 ±0.6	4800	WURZINGER	96	SPEC 1.68 $pd \rightarrow {}^3\text{He}\eta'$
957.46 ±0.33		DUANE	74	MMS $\pi^- p \rightarrow n\text{MM}$
958.2 ±0.5	1414	DANBURG	73	HBC 2.2 $K^- p \rightarrow \Lambda\eta'$
958 ±1	400	JACOBS	73	HBC 2.9 $K^- p \rightarrow \Lambda\eta'$
956.1 ±1.1	3415	¹ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
957.5 ±0.2		BAI	04J	BES2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
959 ±1	630	² BELADIDZE	92C	VES 36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
958 ±1	340	² ARMSTRONG	91B	OMEG 300 $pp \rightarrow pp\eta\pi^+\pi^-$
958.2 ±0.4	622	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
957.8 ±0.2	2420	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
956.3 ±1.0	143	² GIDAL	87	MRK2 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
957.4 ±1.4	535	³ BASILE	71	CNTR 1.6 $\pi^- p \rightarrow n\eta'$
957 ±1		RITTENBERG	69	HBC 1.7-2.7 $K^- p$

NODE=M002M

OCCUR=2

OCCUR=2

¹ Using all η' decays.² Systematic uncertainty not estimated.³ Using η' decays into neutrals. Not independent of the other listed BASILE 71 η' mass measurement.

NODE=M002M;LINKAGE=BS

NODE=M002M;LINKAGE=NS

NODE=M002M;LINKAGE=BA

 $\eta'(958)$ WIDTH

NODE=M002W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.006 OUR FIT					
0.230±0.021 OUR AVERAGE					
0.226±0.017±0.014	2300	CZERWINSKI	10	MMS	$pp \rightarrow pp\eta'$
0.40 ±0.22	4800	WURZINGER	96	SPEC	1.68 $pd \rightarrow {}^3\text{He}\eta'$
0.28 ±0.10	1000	BINNIE	79	MMS	0 $\pi^- p \rightarrow n\text{MM}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.20 ±0.04		BAI	04J	BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

NODE=M002W

 $\eta'(958)$ DECAY MODES

NODE=M002215;NODE=M002

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\pi^+\pi^-\eta$	(42.5 ±0.5) %	DESIG=1
Γ_2 $\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.5 ±0.4) %	DESIG=9
Γ_3 $\rho^0\gamma$		DESIG=213
Γ_4 $\pi^0\pi^0\eta$	(22.4 ±0.5) %	DESIG=2
Γ_5 $\omega\gamma$	(2.52 ±0.07) %	DESIG=7
Γ_6 ωe^+e^-	(2.0 ±0.4) × 10 ⁻⁴	DESIG=205
Γ_7 $\gamma\gamma$	(2.307±0.033) %	DESIG=6
Γ_8 $3\pi^0$	(2.50 ±0.17) × 10 ⁻³	DESIG=8
Γ_9 $\mu^+\mu^-\gamma$	(1.13 ±0.28) × 10 ⁻⁴	DESIG=20
Γ_{10} $\pi^+\pi^-\mu^+\mu^-$	(1.9 ±0.4) × 10 ⁻⁵	DESIG=201
Γ_{11} $\pi^+\pi^-\pi^0$	(3.61 ±0.17) × 10 ⁻³	DESIG=121
Γ_{12} $(\pi^+\pi^-\pi^0)$ S-wave	(3.8 ±0.5) × 10 ⁻³	DESIG=211
Γ_{13} $\pi^\mp\rho^\pm$	(7.4 ±2.3) × 10 ⁻⁴	DESIG=210
Γ_{14} $2(\pi^+\pi^-)$	(8.3 ±0.9) × 10 ⁻⁵	DESIG=131
Γ_{15} $\pi^+\pi^-2\pi^0$	(1.8 ±0.4) × 10 ⁻⁴	DESIG=202
Γ_{16} $2(\pi^+\pi^-)$ neutrals	< 1 %	95% DESIG=132

Γ_{17}	$2(\pi^+\pi^-\pi^0)$	< 1.8	$\times 10^{-3}$	90%	DESIG=141
Γ_{18}	$2(\pi^+\pi^-)2\pi^0$	< 1	%	95%	DESIG=15
Γ_{19}	$3(\pi^+\pi^-)$	< 3.1	$\times 10^{-5}$	90%	DESIG=203
Γ_{20}	$K^\pm\pi^\mp$	< 4	$\times 10^{-5}$	90%	DESIG=207
Γ_{21}	$\pi^+\pi^-e^+e^-$	(2.42 ± 0.10)	$\times 10^{-3}$		DESIG=10
Γ_{22}	$\pi^+e^-\nu_e + \text{c.c.}$	< 2.1	$\times 10^{-4}$	90%	DESIG=204
Γ_{23}	γe^+e^-	(4.91 ± 0.27)	$\times 10^{-4}$		DESIG=28
Γ_{24}	$\pi^0\gamma\gamma$	(3.20 ± 0.24)	$\times 10^{-3}$		DESIG=24
Γ_{25}	$\pi^0\gamma\gamma(\text{non resonant})$	(6.2 ± 0.9)	$\times 10^{-4}$		DESIG=212
Γ_{26}	$\eta\gamma\gamma$	< 1.33	$\times 10^{-4}$	90%	DESIG=214
Γ_{27}	$4\pi^0$	< 4.94	$\times 10^{-5}$	90%	DESIG=26
Γ_{28}	e^+e^-	< 5.6	$\times 10^{-9}$	90%	DESIG=150
Γ_{29}	$e^+e^-e^+e^-$	(4.5 ± 1.1)	$\times 10^{-6}$		DESIG=215
Γ_{30}	invisible	< 6	$\times 10^{-4}$	90%	DESIG=200

**Charge conjugation (C), Parity (P),
Lepton family number (LF) violating modes**

NODE=M002;CLUMP=B

Γ_{31}	$\pi^+\pi^-$	P, CP	< 1.8	$\times 10^{-5}$	90%	DESIG=111
Γ_{32}	$\pi^0\pi^0$	P, CP	< 4	$\times 10^{-4}$	90%	DESIG=25
Γ_{33}	$\pi^0e^+e^-$	C	$[a] < 1.4$	$\times 10^{-3}$	90%	DESIG=16
Γ_{34}	$\pi^0\rho^0$	C	< 4	%	90%	DESIG=18
Γ_{35}	ηe^+e^-	C	$[a] < 2.4$	$\times 10^{-3}$	90%	DESIG=17
Γ_{36}	3γ	C	< 1.0	$\times 10^{-4}$	90%	DESIG=23
Γ_{37}	$\mu^+\mu^-\pi^0$	C	$[a] < 6.0$	$\times 10^{-5}$	90%	DESIG=22
Γ_{38}	$\mu^+\mu^-\eta$	C	$[a] < 1.5$	$\times 10^{-5}$	90%	DESIG=21
Γ_{39}	$e\mu$	LF	< 4.7	$\times 10^{-4}$	90%	DESIG=27

[a] C parity forbids this to occur as a single-photon process.

LINKAGE=CS

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, 2 combinations of partial widths obtained from integrated cross section, and 20 branching ratios uses 52 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 69.5$ for 44 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-25							
x_4	-75	-43						
x_5	-7	-6	-2					
x_7	-11	-7	9	-1				
x_8	-17	-10	19	0	2			
x_{11}	-1	-1	-1	0	0	0		
x_{21}	-8	30	-14	-2	-2	-3	0	
Γ	11	-10	-1	1	-40	0	0	-3
	x_1	x_2	x_4	x_5	x_7	x_8	x_{11}	x_{21}

	Mode	Rate (MeV)	
Γ_1	$\pi^+\pi^-\eta$	0.0799 ± 0.0029	DESIG=1
Γ_2	$\rho^0\gamma(\text{including non-resonant})$	0.0554 ± 0.0019	DESIG=9
	$\pi^+\pi^-\gamma$		
Γ_4	$\pi^0\pi^0\eta$	0.0421 ± 0.0017	DESIG=2
Γ_5	$\omega\gamma$	0.00474 ± 0.00020	DESIG=7
Γ_7	$\gamma\gamma$	0.00434 ± 0.00013	DESIG=6
Γ_8	$3\pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$	DESIG=8
Γ_{11}	$\pi^+\pi^-\pi^0$	$(6.8 \pm 0.4) \times 10^{-4}$	DESIG=121
Γ_{21}	$\pi^+\pi^-e^+e^-$	$(4.54 \pm 0.23) \times 10^{-4}$	DESIG=10

$\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

 $\Gamma(\gamma\gamma)$ Γ_7

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.34±0.14 OUR FIT**4.28±0.19 OUR AVERAGE**

4.17±0.10±0.27	2000	¹ ACCIARRI	98Q L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.53±0.29±0.51	266	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
3.61±0.13±0.48		² BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\eta'(958)$
4.6 ±1.1 ±0.6	23	BARU	90 MD1	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$
4.57±0.25±0.44		BUTLER	90 MRK2	$e^+e^- \rightarrow e^+e^-\eta'(958)$
5.08±0.24±0.71	547	³ ROE	90 ASP	$e^+e^- \rightarrow e^+e^-2\gamma$
3.8 ±0.7 ±0.6	34	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.9 ±0.5 ±0.5	136	⁴ WILLIAMS	88 CBAL	$e^+e^- \rightarrow e^+e^-2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7 ±0.6 ±0.9	143	⁵ GIDAL	87 MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
4.0 ±0.9		⁶ BARTEL	85E JADE	$e^+e^- \rightarrow e^+e^-2\gamma$

¹ No non-resonant $\pi^+\pi^-$ contribution found.² Reevaluated by us using $B(\eta' \rightarrow \rho(770)\gamma) = (30.2 \pm 1.3)\%$.³ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁴ Reevaluated by us using $B(\eta' \rightarrow \gamma\gamma) = (2.11 \pm 0.13)\%$.⁵ Superseded by BUTLER 90.⁶ Systematic error not evaluated.NODE=M002W4
NODE=M002W4NODE=M002W4;LINKAGE=AC
NODE=M002W4;LINKAGE=K1
NODE=M002W4;LINKAGE=K2
NODE=M002W4;LINKAGE=K3
NODE=M002W4;LINKAGE=C
NODE=M002W4;LINKAGE=A $\Gamma(e^+e^-)$ Γ_{28}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<1.1 × 10⁻³ 90 ^{1,2} ACHASOV 15 SND 0.958 $e^+e^- \rightarrow \pi\pi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.0 × 10⁻³ 90 ² ACHASOV 15 SND 0.958 $e^+e^- \rightarrow \pi\pi\eta$ <2.4 × 10⁻³ 90 ² AKHMETSHIN 15 CMD3 0.958 $e^+e^- \rightarrow \pi^+\pi^-\eta$ ¹ Combining data of ACHASOV 15 and AKHMETSHIN 15.² Using η and η' branching fractions from PDG 14.NODE=M002W1
NODE=M002W1

OCCUR=2

NODE=M002W1;LINKAGE=A
NODE=M002W1;LINKAGE=B $\eta'(958) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M002223

This combination of a partial width with the partial width into $\gamma\gamma$ and with the total width is obtained from the integrated cross section into channel(i) in the $\gamma\gamma$ annihilation.

NODE=M002223

 $\Gamma(\gamma\gamma) \times \Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma)) / \Gamma_{\text{total}}$ $\Gamma_7\Gamma_2/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.28±0.04 OUR FIT**1.26±0.07 OUR AVERAGE** Error includes scale factor of 1.2.

1.09±0.04±0.13		BEHREND	91 CELL	$e^+e^- \rightarrow e^+e^-\rho(770)^0\gamma$
1.35±0.09±0.21		AIHARA	87 TPC	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.13±0.04±0.13	867	ALBRECHT	87B ARG	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.53±0.09±0.21		ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.14±0.08±0.11	243	BERGER	84B PLUT	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.73±0.34±0.35	95	JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^-\rho\gamma$
1.49±0.13±0.027	213	BARTEL	82B JADE	$e^+e^- \rightarrow e^+e^-\rho\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.85±0.31±0.24	43	BEHREND	82C CELL	$e^+e^- \rightarrow e^+e^-\rho\gamma$

NODE=M002G1
NODE=M002G1 $\Gamma(\gamma\gamma) \times \Gamma(\pi^0\pi^0\eta) / \Gamma_{\text{total}}$ $\Gamma_7\Gamma_4/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

0.97±0.04 OUR FIT Error includes scale factor of 1.1.**0.92±0.06±0.11** ¹ KARCH 92 CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

² KARCH 90 CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$ ^{2,3} ANTREASYAN 87 CBAL $e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$ ¹ Reevaluated by us using $B(\eta \rightarrow \gamma\gamma) = (39.21 \pm 0.34)\%$. Supersedes ANTREASYAN 87 and KARCH 90.² Superseded by KARCH 92.³ Using $BR(\eta \rightarrow 2\gamma) = (38.9 \pm 0.5)\%$.NODE=M002G2
NODE=M002G2

NODE=M002G2;LINKAGE=K4

NODE=M002G2;LINKAGE=A
NODE=M002G2;LINKAGE=D

$\eta'(958) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M002224

 $\Gamma(\pi^+ \pi^- \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{28} / \Gamma$

VALUE (10^{-3} eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AKHMETSHIN 15	CMD3	$0.958 e^+ e^- \rightarrow \pi^+ \pi^- \eta$
¹ AKHMETSHIN 15 reports $[\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta) \times \Gamma(\eta'(958) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 4.1 \times 10^{-4}$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.				

NODE=M002G01
NODE=M002G01

NODE=M002G01;LINKAGE=A

 $\eta'(958) \text{ BRANCHING RATIOS}$

NODE=M002230

 $\Gamma(\pi^+ \pi^- \eta) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
42.5 $\pm$ 0.5 OUR FIT	Error includes scale factor of 1.1.			
41.24 $\pm$ 0.08 $\pm$ 1.24	312k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
42.4 $\pm$ 1.1 $\pm$ 0.4	1.2k	¹ PEDLAR	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.				

NODE=M002R47
NODE=M002R47

NODE=M002R47;LINKAGE=PE

 $\Gamma(\pi^+ \pi^- \eta(\text{charged decay})) / \Gamma_{\text{total}}$ $0.2804 \Gamma_1 / \Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1191±0.0015 OUR FIT Error includes scale factor of 1.1.				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.123 ±0.014	107	RITTENBERG	69 HBC	1.7–2.7 $K^- p$
0.10 ±0.04	10	LONDON	66 HBC	2.24 $K^- p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$
0.07 ±0.04	7	BADIER	65B HBC	3 $K^- p$

NODE=M002R3
NODE=M002R3 $\Gamma(\pi^+ \pi^- \eta(\text{neutral decay})) / \Gamma_{\text{total}}$ $0.7196 \Gamma_1 / \Gamma$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.306±0.004 OUR FIT	Error includes scale factor of 1.1.			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.314±0.026	281	RITTENBERG 69	HBC	1.7-2.7 K ⁻ p

NODE=M002R1
NODE=M002R1 $\Gamma(\rho^0 \gamma(\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
29.5 $\pm$ 0.4 OUR FIT	Error includes scale factor of 1.1.			
29.90 $\pm$ 0.03 $\pm$ 0.55	913k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
28.7 $\pm$ 0.7 $\pm$ 0.4	0.2k	¹ PEDLAR	09 CLEO	$J/\psi \rightarrow \gamma \eta'$
32.9 $\pm$ 3.3	298	RITTENBERG	69 HBC	$1.7\text{--}2.7 K^- p$
20 $\pm$ 10	20	LONDON	66 HBC	$2.24 K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
34 $\pm$ 9	35	BADIER	65B HBC	$3 K^- p$

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.NODE=M002R6
NODE=M002R6

NODE=M002R6;LINKAGE=PE

 $\Gamma(\rho^0 \gamma) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
33.34 $\pm$ 0.06 $\pm$ 1.60	970k	¹ ABLIKIM	18C BES3	$\eta'(958) \rightarrow \gamma \pi^+ \pi^-$
34.43 $\pm$ 0.52 $\pm$ 1.97	970k	² ABLIKIM	18C BES3	$\eta'(958) \rightarrow \gamma \pi^+ \pi^-$

¹ From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$, $\omega(782)$, and box anomaly components.² From a fit to $\pi^+ \pi^-$ mass using $\rho(770)$, $\omega(782)$, and $\rho(1450)$ components.NODE=M002R66
NODE=M002R66

OCCUR=2

NODE=M002R66;LINKAGE=A
NODE=M002R66;LINKAGE=B $\Gamma(\rho^0 \gamma(\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi^+ \pi^- \eta)$ Γ_2 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.694 $\pm$ 0.014 OUR FIT	Error includes scale factor of 1.1.		
0.683 $\pm$ 0.020 OUR AVERAGE			
0.677 $\pm$ 0.024 $\pm$ 0.011	PEDLAR	09 CLE3	$J/\psi \rightarrow \eta' \gamma$
0.69 $\pm$ 0.03	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta' \gamma$

NODE=M002R43
NODE=M002R43

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi^+ \pi^- \eta (\text{neutral decay}))$$

$$\Gamma_2 / 0.714 \Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.972 ± 0.020 OUR FIT	Error includes scale factor of 1.1.			
0.97 ± 0.09 OUR AVERAGE				
0.70 ± 0.22		AMSLER	04B CBAR	0 $\bar{p} p \rightarrow \pi^+ \pi^- \eta$
1.07 ± 0.17		BELADIDZE	92C VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
0.92 ± 0.14	473	DANBURG	73 HBC	2.2 $K^- p \rightarrow \Lambda X^0$
1.11 ± 0.18	192	JACOBS	73 HBC	2.9 $K^- p \rightarrow \Lambda X^0$

NODE=M002R27
NODE=M002R27

$$\Gamma(\pi^0 \pi^0 \eta) / \Gamma_{\text{total}}$$

$$\Gamma_4 / \Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
22.4 ± 0.6 OUR FIT	Error includes scale factor of 1.1.			
21.36 ± 0.10 ± 0.92	52k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
23.5 ± 1.3 ± 0.4	3.2k	¹ PEDLAR	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R48
NODE=M002R48

¹ Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R48;LINKAGE=PE

$$\Gamma(\pi^0 \pi^0 \eta (3\pi^0 \text{ decay})) / \Gamma_{\text{total}}$$

$$0.321 \Gamma_4 / \Gamma$$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0718±0.0018 OUR FIT	Error includes scale factor of 1.1.			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.11 ±0.06	4	BENSINGER	70 DBC	2.2 $\pi^+ d$

NODE=M002R26
NODE=M002R26

$$\Gamma(\pi^0 \pi^0 \eta) / \Gamma(\pi^+ \pi^- \eta)$$

$$\Gamma_4 / \Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.527 ± 0.019 OUR FIT	Error includes scale factor of 1.1.		
0.555 ± 0.043 ± 0.013	PEDLAR	09 CLE3	$J/\psi \rightarrow \eta' \gamma$

NODE=M002R45
NODE=M002R45

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / \Gamma(\pi \pi \eta)$$

$$\Gamma_2 / (\Gamma_1 + \Gamma_4)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.454±0.009 OUR FIT	Error includes scale factor of 1.1.		
0.43 ±0.02 ±0.02	BARBERIS	98C OMEG	450 $p p \rightarrow p_f \eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.31 ±0.15	DAVIS	68 HBC	5.5 $K^- p$

NODE=M002R7
NODE=M002R7

$$\Gamma(\omega \gamma) / \Gamma_{\text{total}}$$

$$\Gamma_5 / \Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.52 ± 0.07 OUR FIT				
2.50 ± 0.07 OUR AVERAGE				
2.489 ± 0.018 ± 0.074	23k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma \eta'$
2.55 ± 0.03 ± 0.16	33.2k	¹ ABLIKIM	15AD BES3	$J/\psi \rightarrow \eta' \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.34 ± 0.30 ± 0.04	70	² PEDLAR	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R49
NODE=M002R49

¹ Using $B(J/\psi \rightarrow \eta' \gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

² Not independent of other η' branching fractions and ratios in PEDLAR 09.

NODE=M002R49;LINKAGE=A
NODE=M002R49;LINKAGE=PE

$$\Gamma(\omega \gamma) / \Gamma(\pi^+ \pi^- \eta)$$

$$\Gamma_5 / \Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0593 ± 0.0018 OUR FIT	Error includes scale factor of 1.1.			
0.055 ± 0.007 ± 0.001		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta' \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.068 ± 0.013	68	ZANFINO	77 ASPK	8.4 $\pi^- p$

NODE=M002R17
NODE=M002R17

$$\Gamma(\omega \gamma) / \Gamma(\pi^0 \pi^0 \eta)$$

$$\Gamma_5 / \Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.113 ± 0.004 OUR FIT			
0.147 ± 0.016	ALDE	87B GAM2	38 $\pi^- p \rightarrow n 4\gamma$

NODE=M002R33
NODE=M002R33

$$\Gamma(\omega e^+ e^-) / \Gamma(\omega \gamma)$$

$$\Gamma_6 / \Gamma_5$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
7.71 ± 1.34 ± 0.54	¹ ABLIKIM	15AD BES3	$J/\psi \rightarrow \eta' \gamma$

NODE=M002R60
NODE=M002R60

¹ Obtained from other ABLIKIM 15AD measurements with common systematics taken into account.

NODE=M002R60;LINKAGE=A

$$\Gamma(\omega e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.97±0.34±0.17	66	¹ ABLIKIM	15AD BES3	$J/\psi \rightarrow \eta' \gamma$

¹ Using $B(J/\psi \rightarrow \eta' \gamma) = (5.15 \pm 0.16) \times 10^{-3}$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M002R59
NODE=M002R59

NODE=M002R59;LINKAGE=A

$$\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma)) / [\Gamma(\pi^+ \pi^- \eta) + \Gamma(\pi^0 \pi^0 \eta) + \Gamma(\omega \gamma)]$$

$$\Gamma_2/(\Gamma_1+\Gamma_4+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.437±0.008 OUR FIT	Error includes scale factor of 1.1.		

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.25 ±0.14	DAUBER	64	HBC	1.95 $K^- p$

NODE=M002R18
NODE=M002R18

$$[\Gamma(\pi^0 \pi^0 \eta (\text{charged decay})) + \Gamma(\omega (\text{charged decay}) \gamma)] / \Gamma_{\text{total}}$$

$$(0.286\Gamma_4+0.89\Gamma_5)/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0864±0.0017 OUR FIT	Error includes scale factor of 1.1.			

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.045 ±0.029	42	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

NODE=M002R4
NODE=M002R4

$$\Gamma(\pi^+ \pi^- \text{ neutrals})/\Gamma_{\text{total}}$$

$$(0.714\Gamma_1+0.286\Gamma_4+0.89\Gamma_5)/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3897±0.0028 OUR FIT	Error includes scale factor of 1.1.			

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4 ±0.1	39	LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^- \text{ neutrals}$
0.35 ±0.06	33	BADIER	65B	HBC	3 $K^- p$

NODE=M002R2
NODE=M002R2

$$\Gamma(\gamma \gamma)/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.307±0.035 OUR FIT	Error includes scale factor of 1.1.			

2.31 ±0.06 OUR AVERAGE Error includes scale factor of 1.8.

2.331±0.012±0.035	71k	ABLIKIM	19T	BES	$J/\psi \rightarrow \gamma \eta'$
1.99 $^{+0.31}_{-0.27}$ ±0.07	114	¹ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
2.00 ±0.18		² STANTON	80	SPEC	$8.45 \pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$
2.25 ±0.16 ±0.03	0.3k	³ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma \eta'$
1.8 ±0.2	6000	⁴ APEL	79	NICE	$15-40 \pi^- p \rightarrow n 2\gamma$
2.5 ±0.7		DUANE	74	MMS	$\pi^- p \rightarrow n \text{MM}$
1.71 ±0.33	68	DALPIAZ	72	CNTR	$1.6 \pi^- p \rightarrow n X^0$
2.0 $^{+0.8}_{-0.6}$	31	HARVEY	71	OSPK	$3.65 \pi^- p \rightarrow n X^0$

¹ WICHT 08 reports $[\Gamma(\eta'(958) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta' K^+)] = (1.40^{+0.16+0.15}_{-0.15-0.12}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta' K^+) = (7.04 \pm 0.25) \times 10^{-5}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Includes APEL 79 result.

³ Not independent of other η' branching fractions and ratios in PEDLAR 09.

⁴ Data is included in STANTON 80 evaluation.

NODE=M002R19
NODE=M002R19

NODE=M002R19;LINKAGE=WI

NODE=M002R19;LINKAGE=S
NODE=M002R19;LINKAGE=PE
NODE=M002R19;LINKAGE=A

$$\Gamma(\gamma \gamma)/\Gamma(\pi^+ \pi^- \eta)$$

$$\Gamma_7/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0543±0.0012 OUR FIT	Error includes scale factor of 1.1.		
0.053 ±0.004 ±0.001	PEDLAR	09	CLE3 $J/\psi \rightarrow \eta'\gamma$

NODE=M002R46
NODE=M002R46

$$\Gamma(\gamma \gamma)/\Gamma(\rho^0 \gamma (\text{including non-resonant } \pi^+ \pi^- \gamma))$$

$$\Gamma_7/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0783±0.0016 OUR FIT	Error includes scale factor of 1.1.		
0.080 ±0.008	ABLIKIM	06E	BES2 $J/\psi \rightarrow \eta'\gamma$

NODE=M002R42
NODE=M002R42

$$\Gamma(\gamma \gamma)/\Gamma(\pi^0 \pi^0 \eta)$$

$$\Gamma_7/\Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.1031±0.0028 OUR FIT			
0.105 ±0.010 OUR AVERAGE	Error includes scale factor of 1.9.		
0.091 ±0.009	AMSLER	93	CBAR 0.0 $\bar{p} p$
0.112 ±0.002 ±0.006	ALDE	87B	GAM2 38 $\pi^- p \rightarrow n 2\gamma$

NODE=M002R38
NODE=M002R38

$\Gamma(\gamma\gamma)/\Gamma(\pi^0\pi^0\eta(\text{neutral decay}))$ $\Gamma_7/0.714\Gamma_4$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.144±0.004 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.188±0.058	16	APEL	72	OSPK	3.8 $\pi^- p \rightarrow n X^0$

NODE=M002R28
 NODE=M002R28

 $\Gamma(\text{neutrals})/\Gamma_{\text{total}}$ $(0.714\Gamma_4+0.09\Gamma_5+\Gamma_7)/\Gamma$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.185±0.004 OUR FIT Error includes scale factor of 1.1.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.185±0.022	535	BASILE	71	CNTR	1.6 $\pi^- p \rightarrow n X^0$
0.189±0.026	123	RITTENBERG	69	HBC	1.7–2.7 $K^- p$

NODE=M002R5
 NODE=M002R5

 $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

2.50 ±0.17 OUR FIT**3.57 ±0.26 OUR AVERAGE**

3.522±0.082±0.254	2015	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$
4.79 ±0.59 ±1.14	183	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.56 ±0.22 ±0.34	309	² ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(3\pi^0)$

¹ We have added all systematic uncertainties in quadrature to a single value.² Superseded by ABLIKIM 17.

NODE=M002R55
 NODE=M002R55

NODE=M002R55;LINKAGE=A
 NODE=M002R55;LINKAGE=B

 $\Gamma(3\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_8/Γ_4

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

112± 8 OUR FIT**78±10 OUR AVERAGE**

86±19	235	BLIK	08	GAMS	32 $\pi^- p \rightarrow \eta' n$
74±15		ALDE	87B	GAM2	38 $\pi^- p \rightarrow n 6\gamma$
75±18		BINON	84	GAM2	30–40 $\pi^- p \rightarrow n 6\gamma$

NODE=M002R32
 NODE=M002R32

 $\Gamma(\mu^+\mu^-\gamma)/\Gamma(\gamma\gamma)$ Γ_9/Γ_7

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

4.9±1.2 33 VIKTOROV 80 CNTR 25,33 $\pi^- p \rightarrow 2\mu\gamma$

NODE=M002R29
 NODE=M002R29

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.9 ±0.4 OUR AVERAGE [(2.0 ± 0.4) × 10⁻⁵ OUR 2023 AVERAGE]**1.94±0.37±0.02** 53 ¹ ABLIKIM 21I BES3 $J/\psi \rightarrow \gamma\eta'(958)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.9	90	² ABLIKIM	130	BES3	$J/\psi \rightarrow \gamma\eta'$
<24	90	³ NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 21I reports $(1.97 \pm 0.33 \pm 0.19) \times 10^{-5}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.21 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.³ Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.

NODE=M002R50
 NODE=M002R50

NEW

NODE=M002R50;LINKAGE=E

NODE=M002R50;LINKAGE=A
 NODE=M002R50;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\pi^+\pi^-\eta)$ Γ_{10}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.5 90 ¹ NAIK 09 CLEO $J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\mu^+\mu^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 1.3 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R03
 NODE=M002R03

NODE=M002R03;LINKAGE=NA

 $\Gamma(\pi^+\pi^-\mu^+\mu^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{10}/Γ_2

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.0 90 ABLIKIM 130 BES3 $J/\psi \rightarrow \gamma\eta'$

NODE=M002R57
 NODE=M002R57

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.61 $\pm$ 0.18 OUR FIT				
3.61 $\pm$ 0.18 OUR AVERAGE				
3.591 $\pm$ 0.054 $\pm$ 0.174	6067	ABLIKIM	17 BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
4.28 $\pm$ 0.49 $\pm$ 1.11	78	¹ ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$
3.7 $^{+1.1}_{-0.9}$ $\pm$ 0.4		² NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.83 $\pm$ 0.15 $\pm$ 0.39 1014 ³ ABLIKIM 12E BES3 $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$

¹ We have added all systematic uncertainties in quadrature to a single value.

² Not independent of measured value of Γ_{11}/Γ_1 from NAIK 09.

³ Superseded by ABLIKIM 17.

NODE=M002R21
NODE=M002R21

NODE=M002R21;LINKAGE=A
NODE=M002R21;LINKAGE=NA
NODE=M002R21;LINKAGE=B

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 $\pm$ 0.4 OUR FIT				Error includes scale factor of 1.1.
8.27 $^{+2.49}_{-2.12}$ $\pm$ 0.04	20	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (21^{+6}_{-5} \pm 2) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R01
NODE=M002R01

NODE=M002R01;LINKAGE=NA

 $\Gamma((\pi^+\pi^-\pi^0) \text{ S-wave})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
37.63 $\pm$ 0.77 $\pm$ 5.00	6580	¹ ABLIKIM	17 BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$

¹ We have added all systematic uncertainties in quadrature.

NODE=M002R63
NODE=M002R63

NODE=M002R63;LINKAGE=A

 $\Gamma(\pi^\mp\rho^\pm)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.44 $\pm$ 0.60 $\pm$ 2.23	1231	¹ ABLIKIM	17 BES3	$J/\psi \rightarrow \gamma(\pi^\mp\rho^\pm)$

¹ We have added all systematic uncertainties in quadrature.

NODE=M002R62
NODE=M002R62

NODE=M002R62;LINKAGE=A

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.3 $\pm$ 0.9 OUR AVERAGE					$[(8.4 \pm 0.9) \times 10^{-5} \text{ OUR 2023 AVERAGE}]$
8.3 $\pm$ 0.9 $\pm$ 0.1	199	¹ ABLIKIM	14M BES3	$J/\psi \rightarrow \gamma\eta'$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 24	90	² NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$
< 1000	90	RITTENBERG	69 HBC	1.7–2.7 K^-p

¹ ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ = $(4.40 \pm 0.35 \pm 0.30) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent of measured value of Γ_{14}/Γ_1 from NAIK 09.

NODE=M002R24
NODE=M002R24

NEW

NODE=M002R24;LINKAGE=A

NODE=M002R24;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{14}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.6	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)]$ < 1.4×10^{-3} which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R04
NODE=M002R04

NODE=M002R04;LINKAGE=NA

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.78 $\pm$ 0.38 $\pm$ 0.02	84	¹ ABLIKIM	14M BES3	$J/\psi \rightarrow \gamma\eta'$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 27	90	² NAIK	09 CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 14M reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ = $(9.38 \pm 1.79 \pm 0.89) \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent of measured value of Γ_{15}/Γ_1 from NAIK 09.

NODE=M002R51
NODE=M002R51

NODE=M002R51;LINKAGE=A

NODE=M002R51;LINKAGE=NA

$\Gamma(\pi^+\pi^-2\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{15}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-2\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 15 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.				

NODE=M002R05
 NODE=M002R05

NODE=M002R05;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-)\text{ neutrals})/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	DANBURG 73	HBC	$2.2 K^-p \rightarrow \Lambda X^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.01	90	RITTENBERG 69	HBC	$1.7\text{--}2.7 K^-p$

NODE=M002R22
 NODE=M002R22

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.002	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
<0.01	90	RITTENBERG 69	HBC	$1.7\text{--}2.7 K^-p$

NODE=M002R23
 NODE=M002R23

¹ Not independent of measured value of Γ_{17}/Γ_1 from NAIK 09.

NODE=M002R23;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{17}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 11 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.				

NODE=M002R06
 NODE=M002R06

NODE=M002R06;LINKAGE=NA

 $\Gamma(2(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	KALBFLEISCH 64B	HBC	$K^-p \rightarrow \Lambda 2(\pi^+\pi^-)+MM$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.01	90	LONDON 66	HBC	Compilation

NODE=M002R16
 NODE=M002R16

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	¹ ABLIKIM 13U	BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 53	90	² NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
<500	95	KALBFLEISCH 64B	HBC	$K^-p \rightarrow \Lambda 2(\pi^+\pi^-)$

¹ Using $B(J/\psi \rightarrow \gamma\eta'(958)) = (5.16 \pm 0.15) \times 10^{-3}$.

² Not independent of measured value of Γ_{19}/Γ_1 from NAIK 09.

NODE=M002R07;LINKAGE=A
 NODE=M002R07;LINKAGE=NA

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$ Γ_{19}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 3(\pi^+\pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 3.0 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.				

NODE=M002R08
 NODE=M002R08

NODE=M002R08;LINKAGE=NA

 $\Gamma(K^\pm\pi^\mp)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$ Γ_{20}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 $\times 10^{-4}$	90	ABLIKIM 16M	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

NODE=M002R61
 NODE=M002R61

 $\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
2.42$\pm$0.10 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.11 $\pm$ 0.12 $\pm$ 0.14	429	¹ ABLIKIM 130	BES3	$J/\psi \rightarrow \gamma\eta'$
2.5 $^{+1.2}_{-0.9} \pm 0.5$		² NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$
<6	90	RITTENBERG 65	HBC	$2.7 K^-p$

¹ Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.

² Not independent of measured value of Γ_{21}/Γ_1 from NAIK 09.

NODE=M002R12
 NODE=M002R12

NODE=M002R12;LINKAGE=A
 NODE=M002R12;LINKAGE=NA

$$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\pi^+\pi^-\eta)$$

 Γ_{21}/Γ_1

VALUE (units 10^{-3})

EVTs

DOCUMENT ID

TECN

COMMENT

5.69±0.25 OUR FIT

5.51^{+3.00}_{-2.30}±0.03

8

¹

NAIK

09

CLEO

$J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14^{+7}_{-5} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R02
NODE=M002R02

NODE=M002R02;LINKAGE=NA

$$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma(\rho^0\gamma(\text{including non-resonant } \pi^+\pi^-\gamma))$$

 Γ_{21}/Γ_2

VALUE (units 10^{-3})

EVTs

DOCUMENT ID

TECN

COMMENT

8.20±0.31 OUR FIT

8.20±0.16±0.27

2584

ABLIKIM

21J

BES3

$J/\psi \rightarrow \gamma\eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.2 ±0.4 ±0.5

429

¹

ABLIKIM

130

BES3

$J/\psi \rightarrow \gamma\eta'$

¹ Superseded by ABLIKIM 21J.

NODE=M002R56
NODE=M002R56

NODE=M002R56;LINKAGE=A

$$\Gamma(\pi^+e^-\nu_e + \text{c.c.})/\Gamma(\pi^+\pi^-\eta)$$

 Γ_{22}/Γ_1

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<5.0

90

ABLIKIM

13G

BES3

$J/\psi \rightarrow \phi\eta'$

NODE=M002R54
NODE=M002R54

$$\Gamma(\gamma e^+e^-)/\Gamma_{\text{total}}$$

 Γ_{23}/Γ

VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.9

90

BRIERE

00

CLEO

$10.6 e^+e^-$

NODE=M002R40
NODE=M002R40

$$\Gamma(\gamma e^+e^-)/\Gamma(\gamma\gamma)$$

 Γ_{23}/Γ_7

VALUE (units 10^{-2})

EVTs

DOCUMENT ID

TECN

COMMENT

2.13±0.09±0.07

864

ABLIKIM

150

BES3

$J/\psi \rightarrow \gamma e^+e^-$

NODE=M002R00
NODE=M002R00

$$\Gamma(\pi^0\gamma\gamma)/\Gamma_{\text{total}}$$

 Γ_{24}/Γ

VALUE (units 10^{-3})

EVTs

DOCUMENT ID

TECN

COMMENT

3.20±0.07±0.23

3.4k

ABLIKIM

17T

BES3

$J/\psi \rightarrow \gamma\eta'$

NODE=M002R64
NODE=M002R64

$$\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$$

 Γ_{24}/Γ_4

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<37

90

ALDE

87B

GAM2

$38 \pi^- p \rightarrow n 4\gamma$

NODE=M002R35
NODE=M002R35

$$\Gamma(\pi^0\gamma\gamma(\text{non resonant}))/\Gamma_{\text{total}}$$

 Γ_{25}/Γ

VALUE (units 10^{-4})

EVTs

DOCUMENT ID

TECN

COMMENT

6.16±0.64±0.67

655

ABLIKIM

17T

BES3

$J/\psi \rightarrow \gamma\eta'$

NODE=M002R65
NODE=M002R65

$$\Gamma(\eta\gamma\gamma)/\Gamma_{\text{total}}$$

 Γ_{26}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<1.33 × 10⁻⁴

90

ABLIKIM

19AW

BES3

$J/\psi \rightarrow \gamma\eta' \rightarrow \gamma\gamma\gamma 2\gamma$

NODE=M002R67
NODE=M002R67

$$\Gamma(4\pi^0)/\Gamma_{\text{total}}$$

 Γ_{27}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<4.94 × 10⁻⁵

90

ABLIKIM

20E

BES3

$J/\psi \rightarrow \eta'\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.2 × 10⁻⁴

90

DONSKOV

14

GAM4

$32.5 \pi^- p \rightarrow \eta' n$

NODE=M002R58
NODE=M002R58

$$\Gamma(4\pi^0)/\Gamma(\pi^0\pi^0\eta)$$

 Γ_{27}/Γ_4

VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<23

90

ALDE

87B

GAM2

$38 \pi^- p \rightarrow n 8\gamma$

NODE=M002R37
NODE=M002R37

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.6 \times 10^{-9}$	90	¹ ACHASOV 15	SND	$0.958 e^+ e^- \rightarrow \pi\pi\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 12 \times 10^{-9}$	90	² AKHMETSHIN 15	CMD3	$0.958 e^+ e^- \rightarrow \pi^+\pi^-\eta$
$< 2.1 \times 10^{-7}$	90	VOROBYEV 88	ND	$e^+ e^- \rightarrow \pi^+\pi^-\eta$

¹ Combining data of ACHASOV 15 and AKHMETSHIN 15 and using $\Gamma(\eta') = 0.198 \pm 0.009$ MeV.

² Using $\Gamma_{\eta'(958)} = 198 \pm 9$ keV, $B(\eta'(958) \rightarrow \pi^+\pi^-\eta) = (42.9 \pm 0.7)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$.

NODE=M002R39
NODE=M002R39

NODE=M002R39;LINKAGE=B

NODE=M002R39;LINKAGE=A

 $\Gamma(e^+e^-e^+e^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.1 \pm 0.1$	30	¹ ABLIKIM 22E	BES3	$J/\psi \rightarrow \gamma\eta'$

¹ ABLIKIM 22E reports $(4.5 \pm 1.0 \pm 0.5) \times 10^{-6}$ from a measurement of $[\Gamma(\eta'(958) \rightarrow e^+e^-e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))]$ assuming $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$, which we rescale to our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = (5.28 \pm 0.06) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R68
NODE=M002R68

NODE=M002R68;LINKAGE=B

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 9.5	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ Not independent of measured value of Γ_{30}/Γ_1 from NAIK 09.

NODE=M002R52
NODE=M002R52

NODE=M002R52;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1	90	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \text{invisible})/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] < 5.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M002R09
NODE=M002R09

NODE=M002R09;LINKAGE=NA

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	ABLIKIM 13	BES3	$J/\psi \rightarrow \phi\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.69	90	ABLIKIM 06Q	BES	$J/\psi \rightarrow \phi\eta'$

NODE=M002R44
NODE=M002R44

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.18	90	¹ AAIJ 17D	LHCB	$D_{(s)}^+ \rightarrow \pi^+\pi^-\pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.5	90	² ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-$
< 29	90	³ MORI 07A	BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$
< 3.3	90	⁴ MORI 07A	BELL	$\gamma\gamma \rightarrow \pi^+\pi^-$
< 800	95	DANBURG 73	HBC	$2.2 K^-p \rightarrow \Lambda X^0$
< 200	90	RITTENBERG 69	HBC	$1.7-2.7 K^-p$

¹ Using branching fractions of $D_{(s)}^+$ decays from PDG 15.

² ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

³ Taking into account interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

⁴ Without interference with the $\gamma\gamma \rightarrow \pi^+\pi^-$ continuum.

NODE=M002R20
NODE=M002R20

OCCUR=2

NODE=M002R20;LINKAGE=A

NODE=M002R20;LINKAGE=AL

NODE=M002R20;LINKAGE=MO

NODE=M002R20;LINKAGE=MR

 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4 \times 10^{-4}$	90	¹ ABLIKIM 11G	BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

¹ ABLIKIM 11G reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta'(958))] < 2.84 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta'(958)) = 5.28 \times 10^{-3}$.

NODE=M002R53
NODE=M002R53

NODE=M002R53;LINKAGE=AL

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^0\pi^0\eta)$ Γ_{32}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<45	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 4\gamma$

NODE=M002R36
 NODE=M002R36

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	90	BRIERE	00	CLEO $10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<13	90	RITTENBERG	65	HBC $2.7 K^- p$

NODE=M002R8
 NODE=M002R8

 $\Gamma(\pi^0 \rho^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	RITTENBERG	65	HBC $2.7 K^- p$

NODE=M002R10
 NODE=M002R10

 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.4	90	BRIERE	00	CLEO $10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<11	90	RITTENBERG	65	HBC $2.7 K^- p$

NODE=M002R9
 NODE=M002R9

 $\Gamma(3\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{36}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	ALDE	87B	GAM2 $38 \pi^- p \rightarrow n 3\gamma$

NODE=M002R34
 NODE=M002R34

 $\Gamma(\mu^+ \mu^- \pi^0)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	90	DZHELYADIN	81	CNTR $30 \pi^- p \rightarrow \eta' n$

NODE=M002R31
 NODE=M002R31

 $\Gamma(\mu^+ \mu^- \eta)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	DZHELYADIN	81	CNTR $30 \pi^- p \rightarrow \eta' n$

NODE=M002R30
 NODE=M002R30

 $\Gamma(e\mu)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.7	90	BRIERE	00	CLEO $10.6 e^+ e^-$

NODE=M002R41
 NODE=M002R41

 $\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS

NODE=M002225

$$|\text{MATRIX ELEMENT}|^2 = |1 + \alpha Y|^2 + CX + DX^2$$

X and Y are Dalitz variables; α is complex and C , and D are real-valued. Parameters C and D are not necessarily equal to c and d , respectively, in the generalized parameterization following this one. May be different for $\eta'(958) \rightarrow \eta \pi^+ \pi^-$ and $\eta'(958) \rightarrow \eta \pi^0 \pi^0$ decays. Because of different initial assumptions and strong correlations of the parameters we do not average the parameters in the section below.

NODE=M002225

 $\text{Re}(\alpha)$ decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.034 \pm 0.002 \pm 0.002$	351k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.054 \pm 0.004 \pm 0.001$	56k	ABLIKIM	18	BES3 $\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.033 \pm 0.005 \pm 0.003$	44k	¹ ABLIKIM	11	BES3 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.072 \pm 0.012 \pm 0.006$	7k	² AMELIN	05A	VES $28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$-0.021 \pm 0.018 \pm 0.017$	6.7k	³ BRIERE	00	CLEO $10.6 e^+ e^- \rightarrow \eta \pi^+ \pi^- X$
$-0.058 \pm 0.013 \pm 0.003$	5.4k	⁴ ALDE	86	GAM2 $38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
-0.08 ± 0.03		^{4,5} KALBFLEISCH	74	RVUE $\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002A0
 NODE=M002A0

OCCUR=2

¹ See ABLIKIM 11 for the full correlation matrix.

² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.

³ Assuming $\text{Im}(\alpha) = 0$, $C = 0$, and $D = 0$.

⁴ Assuming $C = 0$.

⁵ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

NODE=M002A0;LINKAGE=AB
 NODE=M002A0;LINKAGE=AM

NODE=M002A0;LINKAGE=BR
 NODE=M002A0;LINKAGE=A
 NODE=M002A0;LINKAGE=KA

$Im(\alpha)$ decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.000 \pm 0.019 \pm 0.001$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.000 \pm 0.038 \pm 0.002$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$0.000 \pm 0.049 \pm 0.001$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.0 \pm 0.1 \pm 0.0$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$-0.00 \pm 0.13 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0.0 ± 0.3		^{3,4} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$
¹ See ABLIKIM 11 for the full correlation matrix.				
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.				
³ Assuming $C = 0$.				
⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.				

NODE=M002IA0
 NODE=M002IA0

OCCUR=2

NODE=M002IA0;LINKAGE=AB
 NODE=M002IA0;LINKAGE=AM

NODE=M002IA0;LINKAGE=A
 NODE=M002IA0;LINKAGE=KA

C decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.0027 \pm 0.0024 \pm 0.0015$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.018 \pm 0.009 \pm 0.003$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.020 \pm 0.018 \pm 0.004$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
¹ See ABLIKIM 11 for the full correlation matrix.				
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.				

NODE=M002C0
 NODE=M002C0

NODE=M002C0;LINKAGE=AB
 NODE=M002C0;LINKAGE=AM

D decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.053 \pm 0.004 \pm 0.004$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.061 \pm 0.009 \pm 0.005$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.059 \pm 0.012 \pm 0.004$	44k	¹ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.030 \pm 0.015$	7k	² AMELIN	05A VES	$28 \pi^- A \rightarrow \eta \pi^+ \pi^- \pi^- A^*$
$0.00 \pm 0.03 \pm 0.00$	5.4k	³ ALDE	86 GAM2	$38 \pi^- p \rightarrow n \eta \pi^0 \pi^0$
0		^{3,4} KALBFLEISCH	74 RVUE	$\eta' \rightarrow \eta \pi^+ \pi^-$
¹ See ABLIKIM 11 for the full correlation matrix.				
² Superseded by DOROFEEV 07, which found this parameterization unacceptable. See below.				
³ Assuming $C = 0$.				
⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.				

NODE=M002D0
 NODE=M002D0

OCCUR=2

NODE=M002D0;LINKAGE=AB
 NODE=M002D0;LINKAGE=AM

NODE=M002D0;LINKAGE=AL
 NODE=M002D0;LINKAGE=KA

 $\eta'(958) \rightarrow \eta \pi \pi$ DECAY PARAMETERS

NODE=M002227

$$|\text{MATRIX ELEMENT}|^2 \propto 1 + a Y + b Y^2 + c X + d X^2$$

X and Y are Dalitz variables and a , b , c , and d are real-valued parameters. May be different for $\eta'(958) \rightarrow \eta \pi^+ \pi^-$ and $\eta'(958) \rightarrow \eta \pi^0 \pi^0$ decays. We do not average measurements in the section below because parameter values from each experiment are strongly correlated.

NODE=M002227

a decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-0.077 \pm 0.003 \pm 0.001$		¹ ABLIKIM	23AH BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.056 \pm 0.004 \pm 0.002$	351k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.087 \pm 0.009 \pm 0.006$	56k	ABLIKIM	18 BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.074 \pm 0.008 \pm 0.006$	124k	ADLARSON	18A A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.072 \pm 0.007 \pm 0.008$		² GONZALEZ-S.	18A RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	³ ABLIKIM	11 BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	⁴ BLIK	09 GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	⁵ DOROFEEV	07 VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

NODE=M002DPA
 NODE=M002DPA

OCCUR=2

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.

² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

³ See ABLIKIM 11 for the full correlation matrix.

⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.

⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.

NODE=M002DPA;LINKAGE=B
 NODE=M002DPA;LINKAGE=A

NODE=M002DPA;LINKAGE=AB
 NODE=M002DPA;LINKAGE=BL
 NODE=M002DPA;LINKAGE=DO

b decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.066 \pm 0.006 \pm 0.001$		¹ ABLIKIM 23AH	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.049 \pm 0.006 \pm 0.006$	351k	ABLIKIM 18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.073 \pm 0.014 \pm 0.005$	56k	ABLIKIM 18	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.014 \pm 0.005$	124k	ADLARSON 18A	A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.052 \pm 0.001 \pm 0.002$		² GONZALEZ-S...18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	³ ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	⁴ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	⁵ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.³ See ABLIKIM 11 for the full correlation matrix.⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.NODE=M002DPB
NODE=M002DPB

OCCUR=2

NODE=M002DPB;LINKAGE=B
NODE=M002DPB;LINKAGE=ANODE=M002DPB;LINKAGE=AB
NODE=M002DPB;LINKAGE=BL
NODE=M002DPB;LINKAGE=DO**c decay parameter**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.0027 \pm 0.0024 \pm 0.0018$	351k	ABLIKIM 18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$0.019 \pm 0.011 \pm 0.003$	44k	¹ ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$-0.107 \pm 0.096 \pm 0.003$	15k	² BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$0.015 \pm 0.011 \pm 0.014$	20k	³ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ See ABLIKIM 11 for the full correlation matrix.² From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay.³ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.NODE=M002DPC
NODE=M002DPCNODE=M002DPC;LINKAGE=AB
NODE=M002DPC;LINKAGE=BL
NODE=M002DPC;LINKAGE=DO**d decay parameter**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$-0.068 \pm 0.004 \pm 0.001$		¹ ABLIKIM 23AH	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.063 \pm 0.004 \pm 0.003$	351k	ABLIKIM 18	BES3	$\eta' \rightarrow \eta \pi^+ \pi^-$
$-0.074 \pm 0.009 \pm 0.004$	56k	ABLIKIM 18	BES3	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.050 \pm 0.009 \pm 0.005$	124k	ADLARSON 18A	A2MM	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.051 \pm 0.008 \pm 0.006$		² GONZALEZ-S...18A	RVUE	$\eta' \rightarrow \eta \pi^0 \pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	³ ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	⁴ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	⁵ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Fit IV, ignoring noncusp terms. Supersedes ABLIKIM 18.² Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.³ See ABLIKIM 11 for the full correlation matrix.⁴ From $\eta' \rightarrow \eta \pi^0 \pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.⁵ From $\eta' \rightarrow \eta \pi^+ \pi^-$ decay.NODE=M002DPD
NODE=M002DPD

OCCUR=2

NODE=M002DPD;LINKAGE=B
NODE=M002DPD;LINKAGE=ANODE=M002DPD;LINKAGE=AB
NODE=M002DPD;LINKAGE=BL

NODE=M002DPD;LINKAGE=DO

$$\eta'(958) \beta \text{ PARAMETER}$$

$$|\text{MATRIX ELEMENT}|^2 = (1 + 2\beta Z)$$

See the "Note on η Decay Parameters" in our 1994 edition Physical Review D50 1173 (1994), p. 1454.

NODE=M002226

NODE=M002226

 β decay parameter

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
-0.61 ± 0.08 OUR AVERAGE		Error includes scale factor of 1.2.		
$-0.640 \pm 0.046 \pm 0.047$	1.8k	ABLIKIM 15G	BES3	$J/\psi \rightarrow \gamma (\pi^0 \pi^0 \pi^0)$
-0.59 ± 0.18	235	BLIK 08	GAMS	$32 \pi^- p \rightarrow \eta' n$
-0.1 ± 0.3		ALDE 87B	GAM2	$38 \pi^- p \rightarrow n 3 \pi^0$

NODE=M002B0
NODE=M002B0

$\eta'(958)$ C-NONCONSERVING DECAY PARAMETER

See the note on η decay parameters in the Stable Particle Particle Listings for definition of this parameter.

NODE=M002235

NODE=M002235

DECAY ASYMMETRY PARAMETER FOR $\pi^+\pi^-\gamma$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
-0.03 ±0.04 OUR AVERAGE				
-0.019±0.056		AIHARA 87	TPC	$2\gamma \rightarrow \pi^+\pi^-\gamma$
-0.069±0.078	295	GRIGORIAN 75	STRC	$2.1 \pi^- p$
0.00 ±0.10	103	KALBFLEISCH 75	HBC	$2.18 K^- p \rightarrow \Lambda \pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.07 ±0.08	152	RITTENBERG 65	HBC	$2.1-2.7 K^- p$

NODE=M002A

NODE=M002A

 $\eta'(958) \rightarrow \gamma \ell^+ \ell^-$ TRANSITION FORM FACTOR SLOPE

Related to the effective virtual meson mass Λ , via slope $\approx \Lambda^{-2}$. See e.g. LANDSBERG 85, eq. (3.8), for a detailed definition.

NODE=M002FFL

NODE=M002FFL

VALUE (GeV ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
1.62±0.17 OUR AVERAGE				
1.60±0.17±0.08	864	¹ ABLIKIM 150	BES3	$J/\psi \rightarrow \gamma e^+ e^-$
1.7 ±0.4	33	¹ VIKTOROV 80		$25,33 \pi^- p \rightarrow 2\mu\gamma$

¹ In the single-pole Ansatz where slope = $1/(\Lambda^2 + \gamma^2)$ with Λ , γ being a Breit-Wigner mass, width for the effective contributing vector meson.

NODE=M002FFL

NODE=M002FFL;LINKAGE=A

 $\eta'(958)$ REFERENCES

NODE=M002

ABLIKIM 23AH	PRL 130 081901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62206
ABLIKIM 22E	PR D105 112010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61639
ABLIKIM 21I	PR D103 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61112
ABLIKIM 21J	PR D103 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61114
ABLIKIM 20E	PR D101 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60252
ABLIKIM 19AV	PR D100 052015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60000
ABLIKIM 19T	PRL 122 142002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59773
ABLIKIM 18	PR D97 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58711
ABLIKIM 18C	PRL 120 242003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58843
ADLARSON 18A	PR D98 012001	P. Adlarson <i>et al.</i>	(A2 Collab. at MAMI)	REFID=58957
GONZALEZ-S... 18A	EPJ C78 758	S. Gonzalez-Solis, E. Passemar	(BEIJ, IND+)	REFID=59316
AAJ 17D	PL B764 233	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57702
ABLIKIM 17	PRL 118 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57650
ABLIKIM 17T	PR D96 012005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58013
ABLIKIM 16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57511
ABLIKIM 15AD	PR D92 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56983
ABLIKIM 15G	PR D92 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56602
ABLIKIM 15O	PR D92 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56780
ABLIKIM 15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
ACHASOV 15	PR D91 092010	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=56788
AKHMETSHIN 15	PL B740 273	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	REFID=56386
PDG 15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)	REFID=56977;ERROR=5
ABLIKIM 14M	PRL 112 251801	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55904
DONSKOV 14	MPL A29 1450213	S. Donskov <i>et al.</i>	(GAMS-4 π Collab.)	REFID=56321
PDG 14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ABLIKIM 13	PR D87 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54829
ABLIKIM 13G	PR D87 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54952
ABLIKIM 13O	PR D87 092011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55388
ABLIKIM 13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55582
ABLIKIM 12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
PDG 12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ABLIKIM 11	PR D83 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53646
ABLIKIM 11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53711
CZERWINSKI 10	PRL 105 122001	E. Czerwinski <i>et al.</i>	(COSY-11 Collab.)	REFID=53364
BLIK 09	PAN 72 231	A.M. Blik <i>et al.</i>	(IHEP (Protvino))	REFID=52727
NAIK 09	PRL 102 061801	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52678
PEDLAR 09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
BLIK 08	PAN 71 2124	A. Blik <i>et al.</i>	(GAMS-4 π Collab.)	REFID=52663
LIBBY 08	PRL 101 182002	J. Libby <i>et al.</i>	(CLEO Collab.)	REFID=52591
WICHT 08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
DOROFEEV 07	PL B651 22	V. Dorofeev <i>et al.</i>	(VES Collab.)	REFID=51711
MORI 07A	JPSJ 76 074102	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51691
ABLIKIM 06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM 06Q	PRL 97 202002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51487
AMELIN 05A	PAN 68 372	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=50766
AMSLER 04B	EPJ C33 23	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51079
BAI 04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
BRIERE 00	PRL 84 26	R. Briere <i>et al.</i>	(CLEO Collab.)	REFID=47410
ACCIARRI 98Q	PL B418 399	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46316
BARBERIS 98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
WURZINGER 96	PL B374 283	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=44992
PDG 94	PR D50 1173	L. Montanet <i>et al.</i>	(CERN, LBL, BOST+)	REFID=43653
AMSLER 93	ZPHY C58 175	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43311
BELADIDZE 92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitukov, G.V. Borisov	(SERP+)	REFID=43175
Translated from YAF 55 2748.				

KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=42170
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BEHREND	91	ZPHY C49 401	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41497
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
KARCH	90	PL B249 353	K. Karch <i>et al.</i>	(Crystal Ball Collab.)	REFID=41377
ROE	90	PR D41 17	N.A. Roe <i>et al.</i>	(ASP Collab.)	REFID=41014
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40564
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
WILLIAMS	88	PR D38 1365	D.A. Williams <i>et al.</i>	(Crystal Ball Collab.)	REFID=40567
AIHARA	87	PR D35 2650	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=40009
ALBRECHT	87B	PL B199 457	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40265
ALDE	87B	ZPHY C36 603	D.M. Alde <i>et al.</i>	(LANL, BELG, SERP, LAPP)	REFID=40236
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=40008
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ALDE	86	PL B177 115	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=20310
BARTEL	85E	PL 160B 421	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=10843
LANDSBERG	85	PRPL 128 301	L.G. Landsberg	(SERP)	REFID=10844
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
BERGER	84B	PL 142B 125	C. Berger	(PLUTO Collab.)	REFID=20306
BINON	84	PL 140B 264	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP+)	REFID=20307
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BARTEL	82B	PL 113B 190	W. Bartel <i>et al.</i>	(JADE Collab.)	REFID=20300
BEHREND	82C	PL 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
	Also	PL 125B 518 (errat.)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
DZHELYADIN	81	PL 105B 239	R.I. Dzhelyadin <i>et al.</i>	(SERP)	REFID=10836
STANTON	80	PL B92 353	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)	REFID=40294
VIKTOROV	80	SJNP 32 520	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=20298
		Translated from YAF 32 1005.			
APEL	79	PL 83B 131	W.D. Apel, K.H. Augenstein, E. Bertolucci	(KARLK+)	REFID=20295
BINNIE	79	PL 83B 141	D.M. Binnie <i>et al.</i>	(LOIC)	REFID=20296
ZANFINO	77	PRL 38 930	C. Zanfino <i>et al.</i>	(CARL, MCGI, OHIO+)	REFID=20293
GRIGORIAN	75	NP B91 232	A. Grigorian <i>et al.</i>	(+)	REFID=20287
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
DUANE	74	PRL 32 425	A. Duane <i>et al.</i>	(LOIC, SHMP)	REFID=20284
KALBFLEISCH	74	PR D10 916	G.R. Kalbfleisch	(BNL)	REFID=20286
DANBURG	73	PR D8 3744	J.S. Danburg <i>et al.</i>	(BNL, MICH) JP	REFID=20280
JACOBS	73	PR D8 18	S.M. Jacobs <i>et al.</i>	(BRAN, UMD, SYRA+) JP	REFID=20281
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
APEL	72	PL 40B 680	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20275
DALPIAZ	72	PL 42B 377	P.F. Dalpiaz <i>et al.</i>	(CERN)	REFID=20278
BASILE	71	NC 3A 371	M. Basile <i>et al.</i>	(CERN, BGNA, STRB)	REFID=20270
HARVEY	71	PRL 27 885	E.H. Harvey <i>et al.</i>	(MINN, MICH)	REFID=20272
BENSINGER	70	PL 33B 505	J.R. Bensinger <i>et al.</i>	(WISC)	REFID=20268
RITTENBERG	69	Thesis UCRL 18863	A. Rittenberg	(LRL) I	REFID=20266
DAVIS	68	PL 27B 532	R. Davis <i>et al.</i>	(NWES, ANL)	REFID=20263
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IJP	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
RITTENBERG	65	PRL 15 556	A. Rittenberg, G.R. Kalbfleisch	(LRL, BNL)	REFID=10761
DAUBER	64	PRL 13 449	P.M. Dauber <i>et al.</i>	(UCLA) JP	REFID=20247
KALBFLEISCH	64B	PRL 13 349	G.R. Kalbfleisch, O.I. Dahl, A. Rittenberg	(LRL) JP	REFID=20252

$f_0(980)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the related review(s):
[Scalar Mesons below 1 GeV](#)

NODE=M003

 $f_0(980)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(980-1010) - i (20-35) OUR ESTIMATE (see Fig. 64.4 in the review)			
$(993 \pm 2^{+2}_{-1}) - i(21 \pm 3^{+2}_{-4})$	¹ DANILKIN	21	RVUE Compilation
$(1014 \pm 8) - i(35 \pm 5)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(992.8 \pm 1.3) - i(30.7 \pm 2.3)$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
$(1003^{+5}_{-27}) - i(21^{+10}_{-8})$	³ GARCIA-MAR..11	RVUE	Compilation
$(996 \pm 7) - i(25^{+10}_{-6})$	⁴ GARCIA-MAR..11	RVUE	Compilation
$(996^{+4}_{-14}) - i(24^{+11}_{-3})$	⁵ MOUSSALLAM11	RVUE	Compilation
$(981 \pm 43) - i(18 \pm 11)$	⁶ MENNESSIER 10	RVUE	Compilation
$(1030^{+30}_{-10}) - i(35^{+10}_{-16})$	⁷ ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
$(973^{+39}_{-127}) - i(11^{+189}_{-11})$	⁸ PELAEZ 04A	RVUE	$\pi\pi \rightarrow \pi\pi$

¹ Data driven analysis using partial-wave dispersion relations .

² 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84c ($\eta\eta'$). Based on 18.5k events. Second solution 977.8 ± 1.7 MeV.

³ Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOESCU 73 using Roy equations.

⁴ Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOESCU 73 using GKPY equations.

⁵ Uses Roy equations.

⁶ Average of the analyses of three data sets in the K-matrix model. Uses the data of BATLEY 08A, HYAMS 73 , and GRAYER 74 , partially of COHEN 80 or ETKIN 82B.

⁷ On sheet II in a 2-pole solution. The other pole is found on sheet III at $(850 - i 100)$ MeV.

⁸ Reanalysis of data from PROTOPOESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.

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NODE=M003PP

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→ UNCHECKED ←

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NODE=M003PP;LINKAGE=D

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NODE=M003PP;LINKAGE=F

NODE=M003PP;LINKAGE=G

NODE=M003PP;LINKAGE=H

NODE=M003PP;LINKAGE=A

 $f_0(980)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
990 ±20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$992.0^{+8.5}_{-7.5} \pm 8.6$		¹ AAIJ	19H LHCb	$pp \rightarrow D^\pm X$
989.4 ± 1.3	424	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
989.9 ± 0.4	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
$977^{+11}_{-9} \pm 1$	44	² ECKLUND	09 CLEO	$4.17 e^+ e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
$982.2 \pm 1.0^{+8.1}_{-8.0}$		³ UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
$976.8 \pm 0.3^{+10.1}_{-0.6}$	64k	⁴ AMBROSINO	07 KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$984.7 \pm 0.4^{+2.4}_{-3.7}$	64k	⁵ AMBROSINO	07 KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
973 ± 3	262 ± 30	⁶ AUBERT	07AKBABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$
970 ± 7	54 ± 9	⁶ AUBERT	07AKBABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \pi^0 \gamma$
953 ± 20	2.6k	⁷ BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$985.6^{+1.2}_{-1.5} \pm 1.1$		⁸ MORI	07 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$983.0 \pm 0.6^{+4.0}_{-3.0}$		⁹ AMBROSINO	06B KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

NODE=M003M1

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OCCUR=2

OCCUR=2

977.3 $\pm$ 0.9 $^{+3.7}_{-4.3}$		10	AMBROSINO	06B	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\gamma$	OCCUR=2
950 $\pm$ 9	4286	11	GARMASH	06	BELL	$B^+ \rightarrow K^+\pi^+\pi^-$	
965 $\pm$ 10		12	ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$, ϕK^+K^-	
1031 $\pm$ 8		13	ANISOVICH	03	RVUE		
1037 $\pm$ 31			TIKHOMIROV	03	SPEC	40.0 $\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$	
973 $\pm$ 1	2438	14	ALOISIO	02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
977 $\pm$ 3 $\pm$ 2	848	15	AITALA	01A	E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$	
969.8 $\pm$ 4.5	419	16	ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
985 $^{+16}_{-12}$	419	17,18	ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	OCCUR=2
976 $\pm$ 5 $\pm$ 6		19	AKHMETSHIN	99B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$	
977 $\pm$ 3 $\pm$ 6	268	19	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
975 $\pm$ 4 $\pm$ 6		20	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	OCCUR=2
975 $\pm$ 4 $\pm$ 6		21	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$	OCCUR=3
985 $\pm$ 10			BARBERIS	99	OMEG	450 $pp \rightarrow p_s p_f K^+K^-$	
982 $\pm$ 3			BARBERIS	99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+\pi^-$	
982 $\pm$ 3			BARBERIS	99C	OMEG	450 $pp \rightarrow p_s p_f \pi^0\pi^0$	
987 $\pm$ 6 $\pm$ 6		22	BARBERIS	99D	OMEG	450 $pp \rightarrow K^+K^-$, $\pi^+\pi^-$	
989 $\pm$ 15			BELLAZZINI	99	GAM4	450 $pp \rightarrow pp\pi^0\pi^0$	
991 $\pm$ 3		23	KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
$\sim$ 980		23	OLLER	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
$\sim$ 993.5			OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
$\sim$ 987		23	OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
957 $\pm$ 6		24	ACKERSTAFF	98Q	OPAL	$Z \rightarrow f_0 X$	
960 $\pm$ 10			ALDE	98	GAM4		
1015 $\pm$ 15		23	ANISOVICH	98B	RVUE	Compilation	
1008		25	LOCHER	98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
955 $\pm$ 10		24	ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$	
994 $\pm$ 9		26	BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
993.2 $\pm$ 6.5 $\pm$ 6.9		27	ISHIDA	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
1006			TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$, $\eta\pi$	
997 $\pm$ 5	3k	28	ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	
960 $\pm$ 10	10k	29	ALDE	95B	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	OCCUR=2
994 $\pm$ 5			AMSLER	95B	CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$	
$\sim$ 996		30	AMSLER	95D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0\pi^0\pi^0$, $\pi^0\eta\eta, \pi^0\pi^0\eta$	
987 $\pm$ 6		31	ANISOVICH	95	RVUE		
1015			JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
983		32	BUGG	94	RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
973 $\pm$ 2		33	KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
988		34	ZOU	94B	RVUE		
988 $\pm$ 10		35	MORGAN	93	RVUE	$\pi\pi(K\bar{K}) \rightarrow \pi\pi(K\bar{K})$, $J/\psi \rightarrow \phi\pi\pi(K\bar{K})$, $D_s \rightarrow \pi(\pi\pi)$	
971.1 $\pm$ 4.0		24	AGUILAR-...	91	EHS	400 pp	
979 $\pm$ 4		36	ARMSTRONG	91	OMEG	300 $pp \rightarrow pp\pi\pi$, $ppK\bar{K}$	
956 $\pm$ 12			BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+\pi^-$	
959.4 $\pm$ 6.5		24	AUGUSTIN	89	DM2	$J/\psi \rightarrow \omega\pi^+\pi^-$	
978 $\pm$ 9		24	ABACHI	86B	HRS	$e^+e^- \rightarrow \pi^+\pi^-X$	
985.0 $^{+9.0}_{-39.0}$			ETKIN	82B	MPS	23 $\pi^-p \rightarrow n 2K_S^0$	
974 $\pm$ 4		36	GIDAL	81	MRK2	$J/\psi \rightarrow \pi^+\pi^-X$	
975		37	ACHASOV	80	RVUE		
986 $\pm$ 10		36	AGUILAR-...	78	HBC	0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
969 $\pm$ 5		36	LEEPER	77	ASPK	2-2.4 $\pi^-p \rightarrow \pi^+\pi^-n, K^+K^-n$	
987 $\pm$ 7		36	BINNIE	73	CNTR	$\pi^-p \rightarrow nMM$	
1012 $\pm$ 6		38	GRAYER	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
1007 $\pm$ 20		38	HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$	
997 $\pm$ 6		38	PROTOPOP...	73	HBC	7 $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$	

- ¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.
- ² Using a relativistic Breit-Wigner function and taking into account the finite D_s mass.
- ³ Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K}/g_{f_0 \pi \pi} = 0$.
- ⁴ In the kaon-loop fit.
- ⁵ In the no-structure fit.
- ⁶ Systematic errors not estimated.
- ⁷ FLATTE 76 parameterization. $g_{f_0 \pi \pi} = 329 \pm 96 \text{ MeV}/c^2$ assuming $g_{f_0 K \bar{K}}/g_{f_0 \pi \pi} = 2$.
- ⁸ Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K}/g_{f_0 \pi \pi} = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- ⁹ In the kaon-loop fit following formalism of ACHASOV 89.
- ¹⁰ In the no-structure fit assuming a direct coupling of ϕ to $f_0 \gamma$.
- ¹¹ FLATTE 76 parameterization. Supersedes GARMASH 05.
- ¹² FLATTE 76 parameterization, $g_{f_0 K \bar{K}}/g_{f_0 \pi \pi} = 4.21 \pm 0.25 \pm 0.21$.
- ¹³ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- ¹⁴ From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution.
- ¹⁵ Coupled-channel Breit-Wigner, couplings $g_\pi = 0.09 \pm 0.01 \pm 0.01$, $g_K = 0.02 \pm 0.04 \pm 0.03$.
- ¹⁶ Supersedes ACHASOV 98i. Using the model of ACHASOV 89.
- ¹⁷ Supersedes ACHASOV 98i.
- ¹⁸ In the “narrow resonance” approximation.
- ¹⁹ Assuming $\Gamma(f_0) = 40 \text{ MeV}$.
- ²⁰ From a narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- ²¹ From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- ²² Supersedes BARBERIS 99 and BARBERIS 99B
- ²³ T-matrix pole.
- ²⁴ From invariant mass fit.
- ²⁵ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i) \text{ MeV}$.
- ²⁶ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i) \text{ MeV}$.
- ²⁷ Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- ²⁸ At high $|t|$.
- ²⁹ At low $|t|$.
- ³⁰ On sheet II in a 4-pole solution, the other poles are found on sheet III at $(953-55i) \text{ MeV}$ and on sheet IV at $(938-35i) \text{ MeV}$.
- ³¹ Combined fit of ALDE 95B, ANISOVICH 94, AMSLER 94D.
- ³² On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i) \text{ MeV}$.
- ³³ From sheet II pole position.
- ³⁴ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(797-185i) \text{ MeV}$ and can be interpreted as a shadow pole.
- ³⁵ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i) \text{ MeV}$.
- ³⁶ From coupled channel analysis.
- ³⁷ Coupled channel analysis with finite width corrections.
- ³⁸ Included in AGUILAR-BENITEZ 78 fit.

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$f_0(980)$ WIDTH

Width determination very model dependent. Peak width in $\pi\pi$ is about 50 MeV, but decay width can be much larger.

NODE=M003W1

NODE=M003W1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 to 100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
15.3 ± 4.7	424	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
9.5 ± 1.1	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
$91 \pm_{-22}^{+30} \pm 3$	44	¹ ECKLUND	09 CLEO	$4.17 e^+ e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
$66.9 \pm 2.2 \pm_{-12.5}^{+17.6}$		² UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
65 ± 13	262 ± 30	³ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$

NODE=M003W1

→ UNCHECKED ←

81 ± 21	54 ± 9	3	AUBERT	07AK	BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \pi^0 \gamma$	OCCUR=2
$51.3^{+20.8+13.2}_{-17.7-3.8}$		4	MORI	07	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$	
61 ± 9 $^{+14}_{-8}$	2584	5	GARMASH	05	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$	
64 ± 16		6	ANISOVICH	03	RVUE		
121 ± 23			TIKHOMIROV	03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 70		7	BRAMON	02	RVUE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
44 ± 2 ± 2	848	8	AITALA	01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$	
201 ± 28	419	9	ACHASOV	00H	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	OCCUR=2
122 ± 13	419	10,11	ACHASOV	00H	SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
56 ± 20		12	AKHMETSHIN	99C	CMD2	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$	
65 ± 20			BARBERIS	99	OMEG	$450 pp \rightarrow p_S p_f K^+ K^-$	
80 ± 10			BARBERIS	99B	OMEG	$450 pp \rightarrow p_S p_f \pi^+ \pi^-$	
80 ± 10			BARBERIS	99C	OMEG	$450 pp \rightarrow p_S p_f \pi^0 \pi^0$	
48 ± 12 ± 8		13	BARBERIS	99D	OMEG	$450 pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
65 ± 25			BELLAZZINI	99	GAM4	$450 pp \rightarrow pp \pi^0 \pi^0$	
71 ± 14		14	KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
~ 28		14	OLLER	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 25			OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 14		14	OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
70 ± 20			ALDE	98	GAM4		
86 ± 16		14	ANISOVICH	98B	RVUE	Compilation	
54		15	LOCHER	98	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
69 ± 15		16	ALDE	97	GAM2	$450 pp \rightarrow pp \pi^0 \pi^0$	
38 ± 20		17	BERTIN	97C	OBLX	$0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	
~ 100		18	ISHIDA	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
34			TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$	
48 ± 10	3k	19	ALDE	95B	GAM2	$38 \pi^- p \rightarrow \pi^0 \pi^0 n$	OCCUR=2
95 ± 20	10k	20	ALDE	95B	GAM2	$38 \pi^- p \rightarrow \pi^0 \pi^0 n$	
26 ± 10			AMSLER	95B	CBAR	$0.0 \bar{p}p \rightarrow 3\pi^0$	
~ 112		21	AMSLER	95D	CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$	
80 ± 12		22	ANISOVICH	95	RVUE		
30			JANSSEN	95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
74		23	BUGG	94	RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
29 ± 2		24	KAMINSKI	94	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
46		25	ZOU	94B	RVUE		
48 ± 12		26	MORGAN	93	RVUE	$\pi\pi(K\bar{K}) \rightarrow \pi\pi(K\bar{K}), J/\psi \rightarrow \phi \pi\pi(K\bar{K}), D_s \rightarrow \pi(\pi\pi)$	
37.4 ± 10.6		16	AGUILAR-...	91	EHS	$400 pp$	
72 ± 8		27	ARMSTRONG	91	OMEG	$300 pp \rightarrow pp\pi\pi, ppK\bar{K}$	
110 ± 30			BREAKSTONE	90	SFM	$pp \rightarrow pp\pi^+ \pi^-$	
29 ± 13		16	ABACHI	86B	HRS	$e^+ e^- \rightarrow \pi^+ \pi^- X$	
120 ± 281 ± 20			ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2K_S^0$	
28 ± 10		27	GIDAL	81	MRK2	$J/\psi \rightarrow \pi^+ \pi^- X$	
70 to 300		28	ACHASOV	80	RVUE		
100 ± 80		29	AGUILAR-...	78	HBC	$0.7 \bar{p}p \rightarrow K_S^0 K_S^0$	
30 ± 8		27	LEEPER	77	ASPK	$2-2.4 \pi^- p \rightarrow \pi^+ \pi^- n, K^+ K^- n$	
48 ± 14		27	BINNIE	73	CNTR	$\pi^- p \rightarrow nMM$	
32 ± 10		30	GRAYER	73	ASPK	$17 \pi^- p \rightarrow \pi^+ \pi^- n$	
30 ± 10		30	HYAMS	73	ASPK	$17 \pi^- p \rightarrow \pi^+ \pi^- n$	
54 ± 16		30	PROTOPOP...	73	HBC	$7 \pi^+ p \rightarrow \pi^+ p \pi^+ \pi^-$	

- ¹ Using a relativistic Breit-Wigner function and taking into account the finite D_S mass.
- ² Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 0$.
- ³ Systematic errors not estimated.
- ⁴ Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^0 K K / g_{f_0}^0 \pi\pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- ⁵ Breit-Wigner, solution 1, PWA ambiguous.
- ⁶ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- ⁷ Using the data of AKHMETSHIN 99C, ACHASOV 00H, and ALOISIO 02D.
- ⁸ Breit-Wigner width.
- ⁹ Supersedes ACHASOV 98I. Using the model of ACHASOV 89.
- ¹⁰ Supersedes ACHASOV 98I.
- ¹¹ In the “narrow resonance” approximation.
- ¹² From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- ¹³ Supersedes BARBERIS 99 and BARBERIS 99B
- ¹⁴ T-matrix pole.
- ¹⁵ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i)$ MeV.
- ¹⁶ From invariant mass fit.
- ¹⁷ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i)$ MeV.
- ¹⁸ Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- ¹⁹ At high $|t|$.
- ²⁰ At low $|t|$.
- ²¹ On sheet II in a 4-pole solution, the other poles are found on sheet III at $(953-55i)$ MeV and on sheet IV at $(938-35i)$ MeV.
- ²² Combined fit of ALDE 95B, ANISOVICH 94,
- ²³ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i)$ MeV.
- ²⁴ From sheet II pole position.
- ²⁵ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(797-185i)$ MeV and can be interpreted as a shadow pole.
- ²⁶ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i)$ MeV.
- ²⁷ From coupled channel analysis.
- ²⁸ Coupled channel analysis with finite width corrections.
- ²⁹ From coupled channel fit to the HYAMS 73 and PROTOPOESCU 73 data. With a simultaneous fit to the $\pi\pi$ phase-shifts, inelasticity and to the $K_S^0 K_S^0$ invariant mass.
- ³⁰ Included in AGUILAR-BENITEZ 78 fit.

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NODE=M003W1;LINKAGE=B
NODE=M003W1;LINKAGE=C

NODE=M003W1;LINKAGE=R

NODE=M003215;NODE=M003

DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=4

NODE=M003220

NODE=M003W4
NODE=M003W4

$f_0(980)$ DECAY MODES

Mode		Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	seen
Γ_2	$K\bar{K}$	seen
Γ_3	$\gamma\gamma$	seen
Γ_4	e^+e^-	

$f_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$						Γ_3	
VALUE (keV)		DOCUMENT ID	TECN	COMMENT			
0.29 ^{+0.11}_{-0.06} OUR AVERAGE							
$0.286 \pm 0.017^{+0.211}_{-0.070}$	¹	UEHARA	08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$		
$0.205^{+0.095+0.147}_{-0.083-0.117}$	²	MORI	07	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$		
$0.42 \pm 0.06 \pm 0.18$	³	OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$		

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.32 ± 0.05	⁴ DAI	14A	RVUE	Compilation
0.16 ± 0.01	⁵ MENNESSIER	11	RVUE	
0.29 ± 0.21 ^{+0.02} _{-0.07}	⁶ MOUSSALLAM	11	RVUE	Compilation
0.42	^{7,8} PENNINGTON	08	RVUE	Compilation
0.10	^{8,9} PENNINGTON	08	RVUE	Compilation
0.28 ^{+0.09} _{-0.13}	¹⁰ BOGLIONE	99	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$
0.29 ± 0.07 ± 0.12	^{11,12} BOYER	90	MRK2	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
0.31 ± 0.14 ± 0.09	^{11,12} MARSISKE	90	CBAL	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
0.63 ± 0.14	¹³ MORGAN	90	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-, \pi^0\pi^0$

OCCUR=2

¹ Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K} / g_{f_0 \pi \pi} = 0$.

NODE=M003W4;LINKAGE=UE

² Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K} / g_{f_0 \pi \pi} = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.

NODE=M003W4;LINKAGE=MO

³ OEST 90 quote systematic errors ^{+0.08}_{-0.18}. We use ± 0.18. Observed 60 events.

NODE=M003W4;LINKAGE=H

⁴ Using dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

NODE=M003W4;LINKAGE=D

⁵ Uses an analytic K-matrix model. Compilation.

NODE=M003W4;LINKAGE=ME

⁶ Using dispersion integral with phase input from Roy equations and data from MARSISKE 90, BOYER 90, BEHREND 92, UEHARA 08A, and MORI 07.

NODE=M003W4;LINKAGE=MU

⁷ Solution A (preferred solution based on χ^2 -analysis).

NODE=M003W4;LINKAGE=P1

⁸ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

NODE=M003W4;LINKAGE=P3

⁹ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

NODE=M003W4;LINKAGE=P2

¹⁰ Supersedes MORGAN 90.

NODE=M003W4;LINKAGE=BL

¹¹ From analysis allowing arbitrary background unconstrained by unitarity.

NODE=M003W4;LINKAGE=B

¹² Data included in MORGAN 90, BOGLIONE 99 analyses.

NODE=M003W4;LINKAGE=C

¹³ From amplitude analysis of BOYER 90 and MARSISKE 90, data corresponds to resonance parameters $m = 989$ MeV, $\Gamma = 61$ MeV.

NODE=M003W4;LINKAGE=A

$\Gamma(e^+e^-)$

Γ_4

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<8.4	90	VOROBYEV	88	ND $e^+e^- \rightarrow \pi^0\pi^0$

NODE=M003W3
NODE=M003W3

$f_0(980)$ BRANCHING RATIOS

NODE=M003225

$\Gamma(\pi\pi) / [\Gamma(\pi\pi) + \Gamma(K\bar{K})]$

$\Gamma_1 / (\Gamma_1 + \Gamma_2)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.52 ± 0.12	9.9k	¹ AUBERT	060	BABR $B^\pm \rightarrow K^\pm \pi^\pm \pi^\mp$
0.75 ^{+0.11} _{-0.13}		² ABLIKIM	05Q	BES2 $\chi_{c0} \rightarrow 2\pi^+ 2\pi^-, \pi^+\pi^- K^+ K^-$
0.84 ± 0.02		³ ANISOVICH	02D	SPEC Combined fit
~ 0.68		OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
0.67 ± 0.09		⁴ LOVERRE	80	HBC $4 \pi^- p \rightarrow n 2 K_S^0$
0.81 ^{+0.09} _{-0.04}		⁴ CASON	78	STRC $7 \pi^- p \rightarrow n 2 K_S^0$
0.78 ± 0.03		⁴ WETZEL	76	OSPK $8.9 \pi^- p \rightarrow n 2 K_S^0$

¹ Recalculated by us using $\Gamma(K^+ K^-) / \Gamma(\pi^+ \pi^-) = 0.69 \pm 0.32$ from AUBERT 060 and isospin relations.

NODE=M003R1;LINKAGE=AU

² Using data from ABLIKIM 04G.

NODE=M003R1;LINKAGE=AB

³ From a combined K-matrix analysis of Crystal Barrel ($p\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), GAMS ($\pi p \rightarrow \pi^0\pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M003R;LINKAGE=CH

⁴ Measure $\pi\pi$ elasticity assuming two resonances coupled to the $\pi\pi$ and $K\bar{K}$ channels only.

NODE=M003R1;LINKAGE=B

f₀(980) REFERENCES

NODE=M003

DANILKIN 21 PR D103 114023 I. Danilkin, O. Deineka, M. Vanderhaeghen (MAINZ)
 SARANTSEV 21 PL B816 136227 A.V. Sarantsev et al. (BONN, PNPI)
 ALBRECHT 20 EPJ C80 453 M. Albrecht et al. (Crystal Barrel Collab.)
 AAJ 19H JHEP 1904 063 R. Aaij et al. (LHCb Collab.)
 AOUE 18 PR D98 056021 R.T. Aoude et al.
 ABLIKIM 15P PR D92 012007 M. Ablikim et al. (BESIII Collab.)
 DAI 14A PR D90 036004 L.-Y. Dai, M.R. Pennington (CEBAF)
 ABLIKIM 12E PRL 108 182001 M. Ablikim et al. (BESIII Collab.)
 GARCIA-MAR... 11 PRL 107 072001 R. Garcia-Martin et al. (MADR, CRAC)
 GARCIA-MAR... 11A PR D83 074004 R. Garcia-Martin et al. (MADR, CRAC)
 MENNESSIER 11 PL B696 40 G. Mennessier, S. Narison, X.-G. Wang
 MOUSSALLAM 11 EPJ C71 1814 B. Moussallam
 BATLEY 10C EPJ C70 635 J.R. Batley et al. (CERN NA48/2 Collab.)
 MENNESSIER 10 PL B688 59 G. Mennessier, S. Narison, X.-G. Wang
 ANISOVICH 09 JUMP A24 2481 V.V. Anisovich, A.V. Sarantsev (PNPI)
 ECKLUND 09 PR D80 052009 K.M. Ecklund et al. (CLEO Collab.)
 BATLEY 08A EPJ C54 411 J.R. Batley et al. (CERN NA48/2 Collab.)
 PENNINGTON 08 EPJ C56 1 M.R. Pennington et al.
 UEHARA 08A PR D78 052004 S. Uehara et al. (BELLE Collab.)
 AMBROSINO 07 EPJ C49 473 F. Ambrosino et al. (KLOE Collab.)
 AUBERT 07AK PR D76 012008 B. Aubert et al. (BABAR Collab.)
 BONVICINI 07 PR D76 012001 G. Bonvicini et al. (CLEO Collab.)
 MORI 07 PR D75 051101 T. Mori et al. (BELLE Collab.)
 AMBROSINO 06B PL B634 148 F. Ambrosino et al. (KLOE Collab.)
 AUBERT 06O PR D74 032003 B. Aubert et al. (BABAR Collab.)
 GARMASH 06 PRL 96 251803 A. Garmash et al. (BELLE Collab.)
 ABLIKIM 05 PL B607 243 M. Ablikim et al. (BES Collab.)
 ABLIKIM 05Q PR D72 092002 M. Ablikim et al. (BES Collab.)
 ACHASOV 05 PR D72 013006 N.N. Achasov, G.N. Shestakov
 GARMASH 05 PR D71 092003 A. Garmash et al. (BELLE Collab.)
 ABLIKIM 04G PR D70 092002 M. Ablikim et al. (BES Collab.)
 BUETTAKER 04 EPJ C33 409 P. Buettiker, S. Descotes-Genon, B. Moussallam
 PELAEZ 04A MPL A19 2879 J.R. Pelaez (MADU)
 ANISOVICH 03 EPJ A16 229 V.V. Anisovich et al.
 TIKHOMIROV 03 PAN 66 828 G.D. Tikhomirov et al.
 ALOISIO 02D Translated from YAF 66 860 A. Aloisio et al. (KLOE Collab.)
 ANISOVICH 02D PAN 65 1545 V.V. Anisovich et al.
 BRAMON 02 EPJ C26 253 A. Bramon et al.
 ACHASOV 01F PR D63 094007 N.N. Achasov, V.V. Gubin (Novosibirsk SND Collab.)
 AITALA 01A PRL 86 765 E.M. Aitala et al. (FNAL E791 Collab.)
 AITALA 01B PRL 86 770 E.M. Aitala et al. (FNAL E791 Collab.)
 ACHASOV 00H PL B485 349 M.N. Achasov et al. (Novosibirsk SND Collab.)
 AKHMETSHIN 00B PR B462 371 R.R. Akhmetshin et al. (Novosibirsk CMD-2 Collab.)
 AKHMETSHIN 99C PL B462 380 R.R. Akhmetshin et al. (Novosibirsk CMD-2 Collab.)
 BARBERIS 99 PL B453 305 D. Barberis et al. (Omega Expt.)
 BARBERIS 99B PL B453 316 D. Barberis et al. (Omega Expt.)
 BARBERIS 99C PL B453 325 D. Barberis et al. (Omega Expt.)
 BARBERIS 99D PL B462 462 D. Barberis et al. (Omega Expt.)
 BELLAZZINI 99 PL B467 296 R. Bellazzini et al.
 BOGLIONE 99 EPJ C9 11 M. Boglione, M.R. Pennington
 KAMINSKI 99 EPJ C9 141 R. Kaminski, L. Lesniak, B. Loiseau (CRAC, PARIN)
 OLLER 99 PR D60 099906 (errat.) J.A. Oller et al.
 OLLER 99B NP A652 407 (errat.) J.A. Oller, E. Oset
 OLLER 99C PR D60 074023 J.A. Oller, E. Oset
 ACHASOV 98 PL B440 442 M.N. Achasov et al.
 ACKERSTAFF 98Q EPJ C4 19 K. Ackerstaff et al. (OPAL Collab.)
 ALDE 98 EPJ A3 361 D. Alde et al. (GAM4 Collab.)
 Also PAN 62 405 D. Alde et al. (GAMS Collab.)
 ANISOVICH 98B Translated from YAF 62 446 V.V. Anisovich et al.
 SPU 41 419
 LOCHER 98 EPJ C4 317 M.P. Locher et al. (PSI)
 ALDE 97 PL B397 350 D.M. Alde et al. (GAMS Collab.)
 BERTIN 97C PL B408 476 A. Bertin et al. (OBELIX Collab.)
 ISHIDA 96 PTP 95 745 S. Ishida et al. (TOKY, MIYA, KEK)
 TORNQVIST 96 PRL 76 1575 N.A. Tornqvist, M. Roos (HELS)
 ALDE 95B ZPHY C66 375 D.M. Alde et al. (GAMS Collab.)
 AMSLER 95B PL B342 433 C. Amsler et al. (Crystal Barrel Collab.)
 AMSLER 95D PL B355 425 C. Amsler et al. (Crystal Barrel Collab.)
 ANISOVICH 95 PL B355 363 V.V. Anisovich et al. (PNPI, SERP)
 JANSSEN 95 PR D52 2690 G. Janssen et al. (STON, ADLD, JULI)
 AMSLER 94D PL B333 277 C. Amsler et al. (Crystal Barrel Collab.)
 ANISOVICH 94 PL B323 233 V.V. Anisovich et al. (Crystal Barrel Collab.)
 BUGG 94 PR D50 4412 D.V. Bugg et al. (LOQM)
 KAMINSKI 94 PR D50 3145 R. Kaminski, L. Lesniak, J.P. Maillet (CRAC+)
 ZOU 94B PR D50 591 B.S. Zou, D.V. Bugg (LOQM)
 MORGAN 93 PR D48 1185 D. Morgan, M.R. Pennington (RAL, DURH)
 BEHREND 92 ZPHY C56 381 H.J. Behrend (CELLO Collab.)
 AGUILAR... 91 ZPHY C50 405 M. Aguilar-Benitez et al. (LEBC-EHS Collab.)
 ARMSTRONG 91 ZPHY C51 351 T.A. Armstrong et al. (ATHU, BARI, BIRM+)
 BOYER 90 PR D42 1350 J. Boyer et al. (Mark II Collab.)
 BREAKSTONE 90 ZPHY C48 569 A.M. Breakstone et al. (ISU, BGNA, CERN+)
 MARSISKE 90 PR D41 3324 H. Marsiske et al. (Crystal Ball Collab.)
 MORGAN 90 ZPHY C48 623 D. Morgan, M.R. Pennington (RAL, DURH)
 OEST 90 ZPHY C47 343 T. Oest et al. (JADE Collab.)
 ACHASOV 89 NP B315 465 N.N. Achasov, V.N. Ivanchenko
 AUGUSTIN 89 NP B320 1 J.E. Augustin, G. Cosme (DM2 Collab.)
 VOROBYEV 88 SJNP 48 273 P.V. Vorobiev et al. (NOVO)
 Translated from YAF 48 436
 ABACHI 86B PRL 57 1990 S. Abachi et al. (PURD, ANL, IND, MICH+)
 LONGACRE 86 PL B177 223 R.S. Longacre et al. (BNL, BRAN, CUNY+)
 BINON 84C NC 80A 363 F.G. Binon et al. (BELG, LAPP, SERP+)
 BINON 83 NC 78A 313 F.G. Binon et al. (BELG, LAPP, SERP+)
 ETKIN 82B PR D25 1786 A. Etkin et al. (BNL, CUNY, TUFTS, VAND)
 GIDAL 81 PL 107B 153 G. Gidal et al. (SLAC, LBL)
 ACHASOV 80 SJNP 32 566 N.N. Achasov, S.A. Devyanin, G.N. Shestakov (NOVM)
 Translated from YAF 32 1098
 COHEN 80 PR D22 2595 D. Cohen et al. (ANL) IJP
 LOVERRE 80 ZPHY C6 187 P.F. Loverre et al. (CERN, CDEF, MADR+ IJP)
 AGUILAR... 78 NP B140 73 M. Aguilar-Benitez et al. (MADR, BOMB+)
 CASON 78 PRL 41 271 N.M. Cason et al. (NDAM, ANL)
 LEEPER 77 PR D16 2054 R.J. Leeper et al. (ISU)
 ROSSELET 77 PR D15 574 L. Rosselet et al. (GEVA, SACL)
 FLATTE 76 PL 63B 224 S.M. Flatte (CERN)
 WETZEL 76 NP B115 208 W. Wetzel et al. (ETH, CERN, LOIC)
 HYAMS 75 NP B100 205 B.D. Hyams et al. (CERN, MPIM)
 SRINIVASAN 75 PR D12 681 V. Srinivasan et al. (NDAM, ANL)
 ESTABROOKS 74 NP B79 301 P.G. Estabrooks, A.D. Martin (DURH)
 GRAYER 74 NP B75 189 G. Grayer et al. (CERN, MPIM)
 BINNIE 73 PRL 31 1534 D.M. Binnie et al. (LOIC, SHMP)
 GRAYER 73 Tallahassee G. Grayer et al. (CERN, MPIM)
 HYAMS 73 NP B64 134 B.D. Hyams et al. (CERN, MPIM)
 PROTOPOP... 73 PR D7 1279 S.D. Protopopescu et al. (LBL)

REFID=62088
 REFID=61091
 REFID=60439
 REFID=59670
 REFID=59987
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 REFID=55923
 REFID=54270
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 REFID=48021
 REFID=41004
 REFID=41023
 REFID=20394
 REFID=20768
 REFID=21418
 REFID=20750
 REFID=20390
 REFID=20386
 REFID=20458
 REFID=20381
 REFID=20382
 REFID=20368
 REFID=20370
 REFID=20365
 REFID=11004
 REFID=20446
 REFID=20362
 REFID=20355
 REFID=21062
 REFID=20111
 REFID=20113
 REFID=20343
 REFID=20347
 REFID=20107
 REFID=20108

$a_0(980)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the related review(s):
[Scalar Mesons below 1 GeV](#)

NODE=M036

 $a_0(980)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(970-1020) - i (30-70) OUR ESTIMATE (see Fig. 64.2 in the review) [(960-1030) - i (20-70) MeV OUR 2023 ESTIMATE]			
$(1002.4 \pm 1.4 \pm 6.6)$ $- i(63.5 \pm 2.9)$	¹ ALBRECHT	20	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1000.7^{+12.9}_{-0.7})$ $- i(36.6^{+12.7}_{-2.6})$	² LU	20	RVUE $\gamma\gamma \rightarrow \pi^0 \eta, K_S^0 K_S^0$
$(989 \pm 5) - i(40 \pm 5)$	³ BUGG	08A	RVUE $\bar{p}p$ annihilation data
$(1117^{+24}_{-320}) - i(12^{+43}_{-12})$	⁴ PELAEZ	04A	RVUE $\pi\pi \rightarrow \pi\pi, \pi K \rightarrow \pi K$
$(982 \pm 3) - i(46 \pm 4)$	⁵ ABELE	98	CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$

¹ Pole mass on sheet closest to the physical axis - the more remote pole is extracted at $(1004.1 \pm 1.5 \pm 6.5) - i(48.6 \pm 1.2 \pm 3.4)$ MeV.

² T-matrix pole on sheet II.

³ T-matrix pole on sheet II. Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$. Uses AM-SLER 94D and ABELE 98.

⁴ Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.

⁵ T-matrix pole on sheet II; the pole on sheet III is at $(1006 - i 49)$ MeV.

NODE=M036PP

NODE=M036PP

NODE=M036PP

NEW; $\rightarrow$ UNCHECKED $\leftarrow$

NODE=M036PP;LINKAGE=E

NODE=M036PP;LINKAGE=LU

NODE=M036PP;LINKAGE=C

NODE=M036PP;LINKAGE=A

NODE=M036PP;LINKAGE=D

 $a_0(980)$ MASS

VALUE (MeV)	DOCUMENT ID
980 ± 20 OUR ESTIMATE	Mass determination very model dependent

NODE=M036205

NODE=M036MX

 $\rightarrow$ UNCHECKED $\leftarrow$ **$\eta\pi$ FINAL STATE ONLY**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$982.5 \pm 1.6 \pm 1.1$	16.9k	¹ AMBROSINO	09F	KLOE	$1.02 e^+ e^- \rightarrow \eta\pi^0 \gamma$
986 ± 4		ANISOVICH	09	RVUE	$0.0 \bar{p}p, \pi N$
$982.3^{+0.6}_{-0.7} {}^{+3.1}_{-4.7}$		² UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
$985 \pm 4 \pm 6$	318	ACHARD	02B	L3	$183-209 e^+ e^- \rightarrow$ $e^+ e^- \eta\pi^+ \pi^-$
995^{+52}_{-10}	36	³ ACHASOV	00F	SND	$e^+ e^- \rightarrow \eta\pi^0 \gamma$
994^{+33}_{-8}	36	⁴ ACHASOV	00F	SND	$e^+ e^- \rightarrow \eta\pi^0 \gamma$
975 ± 7		BARBERIS	00H		$450 pp \rightarrow p_f \eta\pi^0 p_s$
988 ± 8		BARBERIS	00H		$450 pp \rightarrow$ $\Delta_f^{++} \eta\pi^- p_s$
~ 1055		⁵ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 1009.2		⁵ OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
993.1 ± 2.1		⁶ TEIGE	99	B852	$18.3 \pi^- p \rightarrow$ $\eta\pi^+ \pi^- n$
988 ± 6		⁵ ANISOVICH	98B	RVUE	Compilation
987		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi,$ $\eta\pi$
991		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi,$ $\eta\pi$
$984.45 \pm 1.23 \pm 0.34$		AMSLER	94C	CBAR	$0.0 \bar{p}p \rightarrow \omega\eta\pi^0$
982 ± 2		⁷ AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
984 ± 4	1040	⁷ ARMSTRONG	91B	OMEG $\pm$	$300 pp \rightarrow$ $pp\eta\pi^+ \pi^-$
976 ± 6		ATKINSON	84E	OMEG $\pm$	$25-55 \gamma p \rightarrow \eta\pi n$
986 ± 3	500	⁸ EVANGELIS...	81	OMEG $\pm$	$12 \pi^- p \rightarrow$ $\eta\pi^+ \pi^- \pi^- p$

OCCUR=2

OCCUR=2

NODE=M036M1
NODE=M036M1

990 ± 7	145	⁸ GURTU	79	HBC ±	4.2 $K^- p \rightarrow \Lambda \eta 2\pi$
980 ± 11	47	CONFORTO	78	OSPK −	4.5 $\pi^- p \rightarrow p X^-$
978 ± 16	50	CORDEN	78	OMEG ±	12–15 $\pi^- p \rightarrow n \eta 2\pi$
977 ± 7		GRASSLER	77	HBC −	16 $\pi^\mp p \rightarrow p \eta 3\pi$
989 ± 4	70	WELLS	75	HBC −	3.1–6 $K^- p \rightarrow \Lambda \eta 2\pi$
972 ± 10	150	DEFOIX	72	HBC ±	0.7 $\bar{p} p \rightarrow 7\pi$
970 ± 15	20	BARNES	69C	HBC −	4–5 $K^- p \rightarrow \Lambda \eta 2\pi$
980 ± 10		CAMPBELL	69	DBC ±	2.7 $\pi^+ d$
980 ± 10	15	MILLER	69B	HBC −	4.5 $K^- N \rightarrow \eta \pi \Lambda$
980 ± 10	30	AMMAR	68	HBC ±	5.5 $K^- p \rightarrow \Lambda \eta 2\pi$

OCCUR=2

¹ Using the model of ACHASOV 89 and ACHASOV 03B.² From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.³ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.⁴ Using the model of JAFFE 77. Supersedes ACHASOV 98B.⁵ T-matrix pole.⁶ Breit-Wigner fit, average between $a_0^\pm$ and a_0^0 . The fit favors a slightly heavier $a_0^\pm$.⁷ From a single Breit-Wigner fit.⁸ From $f_1(1285)$ decay.NODE=M036M1;LINKAGE=AM
NODE=M036M1;LINKAGE=UENODE=M036M1;LINKAGE=V1
NODE=M036M1;LINKAGE=M2
NODE=M036M1;LINKAGE=ANNODE=M036M1;LINKAGE=BF
NODE=M036M1;LINKAGE=A
NODE=M036M1;LINKAGE=R **$K\bar{K}$ ONLY**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

947.7 ⁺ _{−5.0} ± 6.6		¹ AAIJ	19H	LHCB	$pp \rightarrow D^\pm X$
925 ± 5 ± 8	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
~ 1053		³ OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
975 ± 15		BERTIN	98B	OBLX	0.0 $\bar{p} p \rightarrow K^\pm K_S \pi^\mp$
970 ± 10	316	DEBILLY	80	HBC	1.2–2 $\bar{p} p \rightarrow f_1(1285)\omega$
1016 ± 10	100	⁴ ASTIER	67	HBC	0.0 $\bar{p} p$
1003.3 ± 7.0	143	^{5,6} ROSENFELD	65	RVUE	

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.² Using a two-channel resonance parametrization with couplings fixed to ABELE 98.³ T-matrix pole.⁴ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.⁵ Note on J^P . Main argument for 0^+ is small Q value. Isotropy of decay distribution in $\bar{p} p$ at rest proves nothing. See discussion by Rosenfeld (Oxford) and Butterworth (Heidelberg).⁶ Plus systematic errors.

NODE=M036M2;LINKAGE=C

NODE=M036M2;LINKAGE=B
NODE=M036M2;LINKAGE=AN
NODE=M036M2;LINKAGE=A
NODE=M036M2;LINKAGE=01

NODE=M036M2;LINKAGE=S

 $a_0(980)$ WIDTH

NODE=M036210

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

50 to 100 OUR ESTIMATE Width determination very model dependent. Peak width in $\eta\pi$ is about 60 MeV, but decay width can be much larger.

NODE=M036W1

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

75.6 ± 1.6 ^{+17.4} _{−10.0}		¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
50 ± 13 ± 4	318	ACHARD	02B	L3	183–209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
72 ± 16		BARBERIS	00H		450 $pp \rightarrow p_f \eta \pi^0 p_s$
61 ± 19		BARBERIS	00H		450 $pp \rightarrow \Delta_f^{++} \eta \pi^- p_s$
~ 42		² OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 112		² OLLER	99B	RVUE	$\pi\pi \rightarrow \eta\pi, K\bar{K}$
71 ± 7		TEIGE	99	B852	18.3 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
92 ± 20		² ANISOVICH	98B	RVUE	Compilation
65 ± 10		³ BERTIN	98B	OBLX ±	0.0 $\bar{p} p \rightarrow K^\pm K_S \pi^\mp$
~ 100		TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
202		JANSSEN	95	RVUE	$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi, \eta\pi$
54.12 ± 0.34 ± 0.12		AMSLER	94C	CBAR	0.0 $\bar{p} p \rightarrow \omega \eta \pi^0$
54 ± 10		⁴ AMSLER	92	CBAR	0.0 $\bar{p} p \rightarrow \eta \eta \pi^0$

OCCUR=2

95	± 14	1040	⁴ ARMSTRONG 91B	OMEG $\pm$	300 $p p \rightarrow p p \eta \pi^+ \pi^-$
62	± 15	500	⁵ EVANGELIS...	81 OMEG $\pm$	12 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
60	± 20	145	⁵ GURTU	79 HBC $\pm$	4.2 $K^- p \rightarrow \Lambda \eta 2\pi$
60	$\begin{smallmatrix} +50 \\ -30 \end{smallmatrix}$	47	CONFORTO	78 OSPK $-$	4.5 $\pi^- p \rightarrow p X^-$
86.0	$\begin{smallmatrix} +60.0 \\ -50.0 \end{smallmatrix}$	50	CORDEN	78 OMEG $\pm$	12-15 $\pi^- p \rightarrow n \eta 2\pi$
44	± 22		GRASSLER	77 HBC $-$	16 $\pi^\mp p \rightarrow p \eta 3\pi$
80	to 300		⁶ FLATTE	76 RVUE $-$	4.2 $K^- p \rightarrow \Lambda \eta 2\pi$
16.0	$\begin{smallmatrix} +25.0 \\ -16.0 \end{smallmatrix}$	70	⁷ WELLS	75 HBC $-$	3.1-6 $K^- p \rightarrow \Lambda \eta 2\pi$
30	± 5	150	⁸ DEFOIX	72 HBC $\pm$	0.7 $\bar{p} p \rightarrow 7\pi$
40	± 15		CAMPBELL	69 DBC $\pm$	2.7 $\pi^+ d$
60	± 30	15	MILLER	69B HBC $-$	4.5 $K^- N \rightarrow \eta \pi \Lambda$
80	± 30	30	AMMAR	68 HBC $\pm$	5.5 $K^- p \rightarrow \Lambda \eta 2\pi$

¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

² T-matrix pole.

³ The $\eta \pi$ width.

⁴ From a single Breit-Wigner fit.

⁵ From $f_1(1285)$ decay.

⁶ Using a two-channel resonance parametrization of GAY 76B data.

⁷ Weak evidence only for $a_0(980)^+$ production.

⁸ This number has very little meaning. Error is much too small. Vlada

NODE=M036W1;LINKAGE=UE

NODE=M036W1;LINKAGE=AN

NODE=M036W1;LINKAGE=BE

NODE=M036W1;LINKAGE=A

NODE=M036W1;LINKAGE=R

NODE=M036W1;LINKAGE=F

NODE=M036W1;LINKAGE=W

NODE=M036W1;LINKAGE=01

NODE=M036W2

NODE=M036W2

$K\bar{K}$ ONLY

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 48		¹ OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	² ASTIER	67	HBC $\pm$	
57 ± 13	143	³ ROSENFELD	65	RVUE $\pm$	

¹ T-matrix pole.

² ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

³ Plus systematic errors.

NODE=M036W2;LINKAGE=AN

NODE=M036W2;LINKAGE=A

NODE=M036W2;LINKAGE=S

$a_0(980)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta \pi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\eta' \pi$	seen
Γ_4 $\rho \pi$	not seen
Γ_5 $\gamma \gamma$	seen
Γ_6 $e^+ e^-$	

NODE=M036215;NODE=M036

DESIG=1;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=3;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=8

DESIG=2;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=5;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

DESIG=6

$a_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$

Γ_5

VALUE (keV) DOCUMENT ID TECN

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.30 $\pm$ 0.10 ¹ AMSLER 98 RVUE

¹ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta \pi) = 0.24 \pm 0.08$ keV.

NODE=M036217

NODE=M036W4

NODE=M036W4

NODE=M036W4;LINKAGE=A

$a_0(980) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(\eta\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$

$\Gamma_1 \Gamma_5 / \Gamma$

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

0.21 $\begin{smallmatrix} +0.08 \\ -0.04 \end{smallmatrix}$ OUR AVERAGE

0.128 $\begin{smallmatrix} +0.003+0.502 \\ -0.002-0.043 \end{smallmatrix}$		¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
0.28 ± 0.04 ± 0.10	44	OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$
0.19 ± 0.07 $\begin{smallmatrix} +0.10 \\ -0.07 \end{smallmatrix}$		ANTREASYAN	86	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

¹ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

NODE=M036220

NODE=M036G1

NODE=M036G1

NODE=M036G1;LINKAGE=UE

$\Gamma(\eta\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$		$\Gamma_1\Gamma_6/\Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<1.5	90	VOROBYEV	88	ND	$e^+e^- \rightarrow \pi^0\eta$

NODE=M036G2
NODE=M036G2

$a_0(980)$ BRANCHING RATIOS

NODE=M036225

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$		Γ_2/Γ_1			
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.172±0.019 OUR AVERAGE					
0.137±0.036±0.042	¹ ABLIKIM	22AH	BES3		$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
0.23 ±0.05	² ABELE	98	CBAR		$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.166±0.01 ±0.02	³ BARBERIS	98C	OMEG		$450 p p \rightarrow p_f f_1(1285) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.138±0.001±0.035	⁴ ALBRECHT	20	CBAR		$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
1.20 ±0.15	⁵ ANISOVICH	09	RVUE		$0.0 \bar{p}p, \pi N$
1.05 ±0.07 ±0.05	⁶ BUGG	08A	RVUE	0	$\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
0.57 ±0.16	⁷ BARGIOTTI	03	OBLX		$\bar{p}p$
~0.60	OLLER	99B	RVUE		$\pi\pi \rightarrow \eta\pi, K\bar{K}$
0.7 ±0.3	³ CORDEN	78	OMEG		$12-15 \pi^- p \rightarrow n\eta 2\pi$
0.25 ±0.08	³ DEFOIX	72	HBC	±	$0.7 \bar{p} \rightarrow 7\pi$

NODE=M036R2
NODE=M036R2

¹ Using $D_s^+ \rightarrow a_0(980)^+ \pi^0$ from ABLIKIM 19BE.

² Using $\pi^0 \pi^0 \eta$ from AMSLER 94D.

³ From the decay of $f_1(1285)$.

⁴ Residues from T-matrix pole with 2 poles, 2 channels. Solution on adjacent sheet $0.149 \pm 0.001 \pm 0.039$.

⁵ This is a ratio of couplings.

⁶ A ratio of couplings, using AMSLER 94D and ABELE 98. Supersedes BUGG 94.

⁷ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

NODE=M036R2;LINKAGE=B
NODE=M036R2;LINKAGE=Q
NODE=M036R2;LINKAGE=L
NODE=M036R2;LINKAGE=A

NODE=M036R2;LINKAGE=AN
NODE=M036R2;LINKAGE=BU
NODE=M036R;LINKAGE=BG

$\Gamma(\eta'\pi)/\Gamma_{\text{total}}$		Γ_3/Γ			
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
seen	116k	¹ CHEN	20A	BELL	$D^0 \rightarrow K^- \pi^+ \eta$

NODE=M036R00
NODE=M036R00

¹ From an amplitude analysis of the $D^0 \rightarrow K^- \pi^+ \eta$ decay in a three-channel Flatte model with a 10.1 σ significance. Earlier observed by ABLIKIM 17K in the $\chi_{c1} \rightarrow \eta\pi^+ \pi^-$ decay with a 8.9 σ significance.

NODE=M036R00;LINKAGE=A

$\Gamma(\rho\pi)/\Gamma(\eta\pi)$		Γ_4/Γ_1			
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
$\rho\pi$ forbidden.					

NODE=M036R1
NODE=M036R1
NODE=M036R1

• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.25	70	¹ AMMAR	70	HBC	± 4.1,5.5 $K^- p \rightarrow \Lambda\eta 2\pi$
¹ Not clear if they really observed the $a_0(980)$ 3 standard deviations.					

NODE=M036R1;LINKAGE=01

$a_0(980)$ REFERENCES

NODE=M036

ABLIKIM	22AH	PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)
LU	20	EPJ C80 436	J. Lu, B. Moussallam	
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	19BE	PRL 123 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>	
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)
ACHASOV	03B	PR D68 014006	N.N. Achsaov, A.V. Kiselev	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
OLLER	99	PR D60 099906 (errat.)	J.A. Oller <i>et al.</i>	
OLLER	99B	NP A652 407 (errat.)	J.A. Oller, E. Oset	
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset	
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
Translated from UFN 168 481.				

REFID=61880
REFID=60439
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REFID=45863
REFID=46317
REFID=46601
REFID=46331

BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
Translated from YAF 48 436.				
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TINTO, CHIC+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)
Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.				
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIPV)
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)

REFID=46346
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REFID=20399

NODE=M004

$\phi(1020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

$\phi(1020)$ MASS

NODE=M004M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1019.461±0.016 OUR AVERAGE				
1019.463±0.061	2.3M	¹ KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0$
1019.462±0.042±0.056	28k	² LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
1019.51 ±0.02 ±0.05		³ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$
1019.30 ±0.02 ±0.10	105k	AKHMETSHIN 06	CMD2	0.98-1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.52 ±0.05 ±0.05	17.4k	AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.483±0.011±0.025	272k	⁴ AKHMETSHIN 04	CMD2	$\eta\gamma$ $e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	⁵ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
1019.40 ±0.04 ±0.05	23k	AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1019.36 ±0.12		⁶ ACHASOV	00B	SND $e^+e^- \rightarrow \eta\gamma$
1019.38 ±0.07 ±0.08	2200	⁷ AKHMETSHIN 99F	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN 98	CMD2	2γ $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.5 ±0.4		BARBERIS	98	OMEG 450 $pp \rightarrow pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow$ hadrons
1019.7 ±0.3	2012	DAVENPORT	86	MPSF 400 $pA \rightarrow 4KX$
1019.7 ±0.1 ±0.1	5079	ALBRECHT	85D	ARG 10 $e^+e^- \rightarrow K^+K^-X$
1019.3 ±0.1	1500	ARENTON	82	AEMS 11.8 polar. $pp \rightarrow KK$
1019.67 ±0.17	25080	⁸ PELLINEN	82	RVUE
1019.52 ±0.13	3681	BUKIN	78C	OLYA $e^+e^- \rightarrow$ hadrons

NODE=M004M

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1018.4	± 0.5	± 0.1	⁹ ALBRECHT	20	CBAR	$0.9 \bar{p} p \rightarrow$	
						$K^+ K^- \pi^0$	
1019.21	± 0.04	± 0.03	¹⁰ HOID	20	RVUE	$e^+ e^- \rightarrow \pi^0 \gamma$	
1019.54	± 0.10	± 0.51	¹¹ AAIJ	19H	LHCB	$p p \rightarrow D^\pm X$	OCCUR=2
1019.20	± 0.02	± 0.01	¹² HOFERICH...	19	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$	
1019.469	± 0.061	1.7M	KOZYREV	18	CMD3	$e^+ e^- \rightarrow K^+ K^-$	
1019.457	± 0.061	610k	KOZYREV	16	CMD3	$e^+ e^- \rightarrow K_S^0 K_L^0$	
1019.48	± 0.01		LEES	13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$	
1019.441	$\pm 0.008 \pm 0.080$	542k	¹³ AKHMETSHIN	08	CMD2	$1.02 e^+ e^- \rightarrow$	
						$K^+ K^-$	
1019.63	± 0.07	12540	¹⁴ AUBERT,B	05J	BABR	$D^0 \rightarrow \bar{K}^0 K^+ K^-$	
1019.8	± 0.7		ARMSTRONG	86	OMEG	$85 \pi^+ / p p \rightarrow$	
						$\pi^+ / p^4 K p$	
1020.1	± 0.11	5526	¹⁴ ATKINSON	86	OMEG	$20-70 \gamma p$	
1019.7	± 1.0		BEBEK	86	CLEO	$e^+ e^- \rightarrow \gamma(4S)$	
1019.411	± 0.008	642k	¹⁵ DIJKSTRA	86	SPEC	$100-200 \pi^\pm, \bar{p}, p,$	
						$K^\pm, \text{ on Be}$	
1020.9	± 0.2		¹⁴ FRAME	86	OMEG	$13 K^+ p \rightarrow \phi K^+ p$	
1021.0	± 0.2		¹⁴ ARMSTRONG	83B	OMEG	$18.5 K^- p \rightarrow$	
						$K^- K^+ \Lambda$	
1020.0	± 0.5		¹⁴ ARMSTRONG	83B	OMEG	$18.5 K^- p \rightarrow$	OCCUR=2
						$K^- K^+ \Lambda$	
1019.7	± 0.3		¹⁴ BARATE	83	GOLI	$190 \pi^- \text{Be} \rightarrow 2\mu X$	
1019.8	± 0.2	± 0.5	IVANOV	81	OLYA	$1-1.4 e^+ e^- \rightarrow$	
						$K^+ K^-$	
1019.4	± 0.5	337	COOPER	78B	HBC	$0.7-0.8 \bar{p} p \rightarrow$	
						$K_S^0 K_L^0 \pi^+ \pi^-$	
1020	± 1	383	¹⁴ BALDI	77	CNTR	$10 \pi^- p \rightarrow \pi^- \phi p$	OCCUR=2
1018.9	± 0.6	800	COHEN	77	ASPK	$6 \pi^\pm N \rightarrow$	
						$K^+ K^- N$	
1019.7	± 0.5	454	KALBFLEISCH	76	HBC	$2.18 K^- p \rightarrow \Lambda K \bar{K}$	
1019.4	± 0.8	984	BESCH	74	CNTR	$2 \gamma p \rightarrow p K^+ K^-$	
1020.3	± 0.4	100	BALLAM	73	HBC	$2.8-9.3 \gamma p$	
1019.4	± 0.7		BINNIE	73B	CNTR	$\pi^- p \rightarrow \phi n$	
1019.6	± 0.5	120	¹⁶ AGUILAR-...	72B	HBC	$3.9, 4.6 K^- p \rightarrow$	
						$\Lambda K^+ K^-$	
1019.9	± 0.5	100	¹⁶ AGUILAR-...	72B	HBC	$3.9, 4.6 K^- p \rightarrow$	OCCUR=2
						$K^- p K^+ K^-$	
1020.4	± 0.5	131	COLLEY	72	HBC	$10 K^+ p \rightarrow K^+ p \phi$	
1019.9	± 0.3	410	STOTTLE...	71	HBC	$2.9 K^- p \rightarrow$	
						$\Sigma / \Lambda K \bar{K}$	
¹ Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.							NODE=M004M;LINKAGE=G
² Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.							NODE=M004M;LINKAGE=E
³ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.							NODE=M004M;LINKAGE=C
⁴ Update of AKHMETSHIN 99D							NODE=M004M;LINKAGE=GS
⁵ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta \gamma$ decay modes and using ACHASOV 00B for the $\eta \gamma$ decay mode.							NODE=M004M;LINKAGE=AE
⁶ Using a total width of 4.43 ± 0.05 MeV. Systematic uncertainty included.							NODE=M004M;LINKAGE=G2
⁷ Using a total width of 4.43 ± 0.05 MeV.							NODE=M004M;LINKAGE=F2
⁸ PELLINEN 82 review includes AKERLOF 77, DAUM 81, BALDI 77, AYRES 74, DE-GROOT 74.							NODE=M004M;LINKAGE=R
⁹ Width fixed at 4.2 MeV.							NODE=M004M;LINKAGE=J
¹⁰ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization. Inclusion of vacuum polarization gives 1019.457 ± 0.020 MeV.							NODE=M004M;LINKAGE=M
¹¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.							NODE=M004M;LINKAGE=I
¹² The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.							NODE=M004M;LINKAGE=N
¹³ Strongly correlated with AKHMETSHIN 04.							NODE=M004M;LINKAGE=AH
¹⁴ Systematic errors not evaluated.							NODE=M004M;LINKAGE=A
¹⁵ Weighted and scaled average of 12 measurements of DIJKSTRA 86.							NODE=M004M;LINKAGE=B
¹⁶ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.							NODE=M004M;LINKAGE=D

$\phi(1020)$ WIDTH

NODE=M004W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.249±0.013 OUR AVERAGE				
Error includes scale factor of 1.1.				
4.245±0.013	2.3M	¹ KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-$, $K_S^0 K_L^0$
4.205±0.103±0.067	28k	² LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
4.29 ±0.04 ±0.07		³ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^- \gamma$
4.30 ±0.06 ±0.17	105k	AKHMETSHIN 06	CMD2	0.98–1.06 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.280±0.033±0.025	272k	⁴ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
4.21 ±0.04	1900k	⁵ ACHASOV	01E	SND $e^+e^- \rightarrow K^+K^-$, $K_S K_L, \pi^+\pi^-\pi^0$
4.44 ±0.09	55600	AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow$ hadrons
4.5 ±0.7	1500	ARENTON	82	AEMS 11.8 polar. $pp \rightarrow KK$
4.2 ±0.6	766	⁶ IVANOV	81	OLYA 1–1.4 $e^+e^- \rightarrow K^+K^-$
4.3 ±0.6		⁶ CORDIER	80	DM1 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.36 ±0.29	3681	⁶ BUKIN	78C	OLYA $e^+e^- \rightarrow$ hadrons
4.4 ±0.6	984	⁶ BESCH	74	CNTR $2\gamma p \rightarrow pK^+K^-$
4.67 ±0.72	681	⁶ BALAKIN	71	OSPK $e^+e^- \rightarrow$ hadrons
4.09 ±0.29		BIZOT	70	OSPK $e^+e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4.07 ±0.13 ±0.01		⁷ HOID	20	RVUE $e^+e^- \rightarrow \pi^0 \gamma$
4.23 ±0.04 ±0.02		⁸ HOFERICH... 19	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
4.249±0.015	1.7M	KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-$
4.240±0.017	610k	KOZYREV	16	CMD3 $e^+e^- \rightarrow K_S^0 K_L^0$
4.37 ±0.02		LEES	13F	BABR $D^+ \rightarrow K^+K^-\pi^+$
4.24 ±0.02 ±0.03	542k	⁹ AKHMETSHIN 08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
4.28 ±0.13	12540	¹⁰ AUBERT,B	05J	BABR $D^0 \rightarrow \bar{K}^0 K^+K^-$
4.45 ±0.06	271k	DIJKSTRA	86	SPEC 100 π^- Be
3.6 ±0.8	337	⁶ COOPER	78B	HBC 0.7–0.8 $\bar{p}p \rightarrow K_S^0 K_L^0 \pi^+\pi^-$
4.5 ±0.50	1300	^{6,10} AKERLOF	77	SPEC 400 $pA \rightarrow K^+K^-X$
4.5 ±0.8	500	^{6,10} AYRES	74	ASPK 3–6 $\pi^- p \rightarrow K^+K^-n, K^-p \rightarrow K^+K^-\Lambda/\Sigma^0$
3.81 ±0.37		COSME	74B	OSPK $e^+e^- \rightarrow K_L^0 K_S^0$
3.8 ±0.7	454	⁶ BORENSTEIN 72	HBC	2.18 $K^-p \rightarrow K\bar{K}n$

¹ Average of KOZYREV 16 and KOZYREV 18 values taking into account the correlated uncertainties. Supersedes individual KOZYREV 16 and KOZYREV 18 results.

² Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

³ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations.

⁴ Update of AKHMETSHIN 99D

⁵ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S K_L$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

⁶ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁷ The values were extracted from a dispersively improved Breit-Wigner parameterization.

⁸ The values were extracted from a dispersively improved Breit-Wigner parameterization and do not include vacuum polarization.

⁹ Strongly correlated with AKHMETSHIN 04.

¹⁰ Systematic errors not evaluated.

NODE=M004W

OCCUR=2

NODE=M004W;LINKAGE=G

NODE=M004W;LINKAGE=E

NODE=M004W;LINKAGE=C

NODE=M004W;LINKAGE=GS

NODE=M004W;LINKAGE=AE

NODE=M004W;LINKAGE=D

NODE=M004W;LINKAGE=I

NODE=M004W;LINKAGE=K

NODE=M004W;LINKAGE=AH

NODE=M004W;LINKAGE=A

$\phi(1020)$ DECAY MODES

NODE=M004215;NODE=M004

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 K^+K^-	(49.1 ±0.5) %	S=1.3
Γ_2 $K_L^0 K_S^0$	(33.9 ±0.4) %	S=1.2
Γ_3 $\rho\pi + \pi^+\pi^-\pi^0$	(15.4 ±0.4) %	S=1.2
Γ_4 $\pi^+\pi^-\pi^0$		
Γ_5 $\eta\gamma$	(1.301±0.024) %	S=1.2
Γ_6 $\pi^0\gamma$	(1.32 ±0.05) $\times 10^{-3}$	
Γ_7 $\ell^+\ell^-$	—	
Γ_8 e^+e^-	(2.979±0.033) $\times 10^{-4}$	S=1.2
Γ_9 $\mu^+\mu^-$	(2.85 ±0.22) $\times 10^{-4}$	S=1.2

DESIG=1

DESIG=2

DESIG=24

DESIG=3

DESIG=4

DESIG=7

DESIG=256;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=6

Γ_{10}	$\eta e^+ e^-$	$(1.08 \pm 0.04) \times 10^{-4}$		DESIG=17
Γ_{11}	$\pi^+ \pi^-$	$(7.3 \pm 1.3) \times 10^{-5}$		DESIG=8
Γ_{12}	$\omega \pi^0$	$(4.7 \pm 0.5) \times 10^{-5}$		DESIG=25
Γ_{13}	$\omega \gamma$	< 5	% CL=84%	DESIG=10
Γ_{14}	$\rho \gamma$	< 1.2	$\times 10^{-5}$ CL=90%	DESIG=12
Γ_{15}	$\pi^+ \pi^- \gamma$	$(4.1 \pm 1.3) \times 10^{-5}$		DESIG=9
Γ_{16}	$f_0(980) \gamma$	$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1	DESIG=20
Γ_{17}	$\pi^0 \pi^0 \gamma$	$(1.12 \pm 0.06) \times 10^{-4}$		DESIG=19
Γ_{18}	$\pi^+ \pi^- \pi^+ \pi^-$	$(3.9 \pm_{-2.2}^{+2.8}) \times 10^{-6}$		DESIG=15
Γ_{19}	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	< 4.6	$\times 10^{-6}$ CL=90%	DESIG=14
Γ_{20}	$\pi^0 e^+ e^-$	$(1.33 \pm_{-0.10}^{+0.07}) \times 10^{-5}$		DESIG=21
Γ_{21}	$\pi^0 \eta \gamma$	$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5	DESIG=22
Γ_{22}	$a_0(980) \gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		DESIG=23
Γ_{23}	$K^0 \bar{K}^0 \gamma$	< 1.9	$\times 10^{-8}$ CL=90%	DESIG=257
Γ_{24}	$\eta'(958) \gamma$	$(6.21 \pm 0.20) \times 10^{-5}$		DESIG=194
Γ_{25}	$\eta \pi^0 \pi^0 \gamma$	< 2	$\times 10^{-5}$ CL=90%	DESIG=195
Γ_{26}	$\mu^+ \mu^- \gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		DESIG=196
Γ_{27}	$\rho \gamma \gamma$	< 1.2	$\times 10^{-4}$ CL=90%	DESIG=250
Γ_{28}	$\eta \pi^+ \pi^-$	< 1.8	$\times 10^{-5}$ CL=90%	DESIG=255
Γ_{29}	$\eta \mu^+ \mu^-$	< 9.4	$\times 10^{-6}$ CL=90%	DESIG=26
Γ_{30}	$\eta U \rightarrow \eta e^+ e^-$	< 1	$\times 10^{-6}$ CL=90%	DESIG=259
Γ_{31}	invisible	< 1.7	$\times 10^{-4}$ CL=90%	DESIG=260

Lepton Family number (LF) violating modes

Γ_{32}	$e^\pm \mu^\mp$	LF	< 2	$\times 10^{-6}$	CL=90%

NODE=M004;CLUMP=A
DESIG=258

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 80 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 61.8$ for 67 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-72									
x_3	-61	-12								
x_5	-19	17	2							
x_6	-11	11	1	8						
x_8	47	-50	-8	-35	-22					
x_9	-5	4	1	3	2	-9				
x_{11}	-3	3	0	2	1	-6	1			
x_{12}	-4	4	1	3	2	-8	1	0		
x_{16}	0	0	0	0	0	0	0	0	0	
x_{17}	-9	9	1	18	4	-18	2	1	1	0
x_{18}	-1	1	0	1	0	-2	0	0	0	0
x_{22}	0	0	0	0	0	0	0	0	0	0
x_{24}	-6	5	1	32	2	-11	1	1	1	0
	x_1	x_2	x_3	x_5	x_6	x_8	x_9	x_{11}	x_{12}	x_{16}
x_{18}	0									
x_{22}	0	0								
x_{24}	6	0	0							
	x_{17}	x_{18}	x_{22}							

$\phi(1020)$ PARTIAL WIDTHS

NODE=M004218

$\Gamma(\eta\gamma)$ Γ_5

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

58.9 ± 0.5 ± 2.4	ACHASOV	00	SND $e^+e^- \rightarrow \eta\gamma$

NODE=M004W6
NODE=M004W6

 $\Gamma(\pi^0\gamma)$ Γ_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.40 ± 0.16 ^{+0.43} _{-0.40}	ACHASOV	00	SND $e^+e^- \rightarrow \pi^0\gamma$

NODE=M004W7
NODE=M004W7

 $\Gamma(\ell^+\ell^-)$ Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.320 ± 0.017 ± 0.015	¹ AMBROSINO	05	KLOE 1.02 $e^+e^- \rightarrow \mu^+\mu^-$

¹ Weighted average of Γ_{ee} and $\sqrt{\Gamma_{ee}\Gamma_{\mu\mu}}$ from AMBROSINO 05 assuming lepton universality.

NODE=M004W5
NODE=M004W5

NODE=M004W5;LINKAGE=AM

 $\Gamma(e^+e^-)$ Γ_8

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

1.27 ± 0.04 OUR EVALUATION

1.251 ± 0.021 OUR AVERAGE Error includes scale factor of 1.1.

1.235 ± 0.006 ± 0.022	¹ AKHMETSHIN	11	CMD2 1.02 $e^+e^- \rightarrow \phi$
1.32 ± 0.05 ± 0.03	² AMBROSINO	05	KLOE 1.02 $e^+e^- \rightarrow e^+e^-$
1.28 ± 0.05	AKHMETSHIN	95	CMD2 1.02 $e^+e^- \rightarrow \phi$

¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-$, $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, $\eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

² From forward-backward asymmetry and using $\Gamma_{\text{total}} = 4.26 \pm 0.05$ MeV from the 2004 edition of this Review.

NODE=M004W8
NODE=M004W8

→ UNCHECKED ←

NODE=M004W8;LINKAGE=AK

NODE=M004W8;LINKAGE=AM

 $(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{\frac{1}{2}}$ $(\Gamma_8\Gamma_9)^{\frac{1}{2}}$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

1.320 ± 0.018 ± 0.017	AMBROSINO	05	KLOE 1.02 $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M004W9
NODE=M004W9

 $\phi(1020) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M004223

 $\Gamma(K^+K^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.6340 ± 0.0070 ± 0.0039		¹ LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.669 ± 0.001 ± 0.023	1.7M	KOZYREV	18	CMD3 $e^+e^- \rightarrow K^+K^-$

¹ Using a phenomenological model based on KUHN 90 with a sum of Breit-Wigner resonances for $\rho(770)$, $\omega(782)$, $\phi(1020)$ and their higher mass excitations. The first error combines statistical and systematic uncertainties. The second one is due to the parametrization of the charged kaon form factor and mass calibration.

NODE=M004G01
NODE=M004G01

NODE=M004G01;LINKAGE=A

 $\Gamma(K_L^0 K_S^0) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_2\Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.4200 ± 0.0033 ± 0.0123	28k	¹ LEES	14H	BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$

¹ Using a vector meson dominance model with contribution from $\phi(1020)$ and higher mass excitations of $\rho(770)$, $\omega(782)$, and $\phi(1020)$.

NODE=M004GXX
NODE=M004GXX

NODE=M004GXX;LINKAGE=A

 $[\Gamma(\rho\pi) + \Gamma(\pi^+\pi^-\pi^0)] \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_3\Gamma_8/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

184.1 ± 2.1 ± 8.0	¹ LEES	21B	BABR 10.5 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

¹ From the cross section for $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ with contributions from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

NODE=M004R03
NODE=M004R03

NODE=M004R03;LINKAGE=A

$\phi(1020) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$ $\Gamma(K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

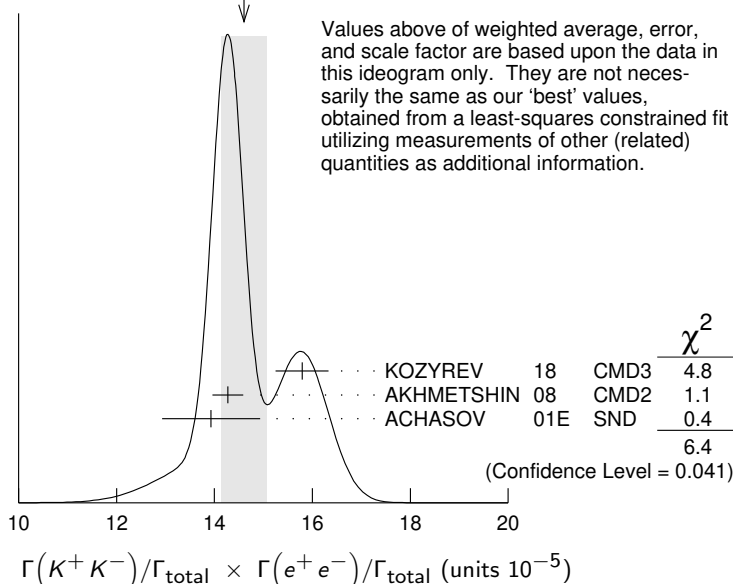
14.64 ±0.27 OUR FIT Error includes scale factor of 1.4. $[(14.64 \pm 0.28) \times 10^{-5}]$ OUR 2023 FIT Scale factor = 1.4]

14.6 ±0.5 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.

15.789 ±0.541	1.7M	KOZYREV	18	CMD3	$e^+ e^- \rightarrow K^+ K^-$
14.27 ±0.05 ±0.31	542k	AKHMETSHIN	08	CMD2	$1.02 e^+ e^- \rightarrow K^+ K^-$
13.93 ±0.14 ±0.99	1000k	¹ ACHASOV	01E	SND	$e^+ e^- \rightarrow K^+ K^-, K_S K_L, \pi^+ \pi^- \pi^0$

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta \gamma$ decays modes and using ACHASOV 00B for the $\eta \gamma$ decay mode.

WEIGHTED AVERAGE
14.6 ±0.5 (Error scaled by 1.8)

 $\Gamma(K_L^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_2 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

10.11 ±0.12 OUR FIT

10.07 ±0.13 OUR AVERAGE

10.078 ±0.223	610k	¹ KOZYREV	16	CMD3	$e^+ e^- \rightarrow K_S^0 K_L^0$
10.01 ±0.04 ±0.17	272k	² AKHMETSHIN	04	CMD2	$e^+ e^- \rightarrow K_L^0 K_S^0$
10.27 ±0.07 ±0.34	500k	³ ACHASOV	01E	SND	$e^+ e^- \rightarrow K^+ K^-, K_S K_L, \pi^+ \pi^- \pi^0$

¹ KOZYREV 16 also reports $\Gamma(e^+ e^-) B(\phi \rightarrow K_S^0 K_L^0) = (0.428 \pm 0.001 \pm 0.009) \text{ keV}$.

² Update of AKHMETSHIN 99D

³ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, and $\eta \gamma$ decays modes and using ACHASOV 00B for the $\eta \gamma$ decay mode.

 $[\Gamma(\rho \pi) + \Gamma(\pi^+ \pi^- \pi^0)] / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_3 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

4.58 ±0.11 OUR FIT Error includes scale factor of 1.1.

4.51 ±0.14 OUR AVERAGE

4.51 ±0.16 ±0.11	105k	AKHMETSHIN	06	CMD2	$0.98-1.06 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.665 ±0.042 ±0.261	400k	¹ ACHASOV	01E	SND	$e^+ e^- \rightarrow K^+ K^-, K_S K_L, \pi^+ \pi^- \pi^0$
4.35 ±0.27 ±0.08	11169	² AKHMETSHIN	98	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
• • •					• • •
4.38 ±0.12		BENAYOUN	10	RVUE	$0.4-1.05 e^+ e^-$
4.30 ±0.08 ±0.21		³ AUBERT,B	04N	BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$

NODE=M004224

NODE=M004G10
NODE=M004G10

NEW

NODE=M004G10;LINKAGE=AE

NODE=M004G6
NODE=M004G6

NODE=M004G6;LINKAGE=A
NODE=M004G;LINKAGE=GS
NODE=M004G6;LINKAGE=AE

NODE=M004G7
NODE=M004G7

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

² Recalculated by us from the cross section in the peak.

³ Superseded by LEES 21B.

NODE=M004G7;LINKAGE=AE

NODE=M004G;LINKAGE=B

NODE=M004G7;LINKAGE=A

NODE=M004G2

NODE=M004G2

NEW

$\Gamma(\eta\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_5/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

3.88 ± 0.07 OUR FIT Error includes scale factor of 1.2. $[(3.88 \pm 0.07) \times 10^{-6}]$ OUR 2023 FIT Scale factor = 1.2]

3.93 ± 0.09 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

4.050 ± 0.067 ± 0.118 33k ¹ ACHASOV 07B SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

4.093^{+0.040}_{-0.043} ± 0.247 17.4k ² AKHMETSHIN 05 CMD2 0.60–1.38 $e^+e^- \rightarrow \eta\gamma$

3.850 ± 0.041 ± 0.159 23k ^{3,4} AKHMETSHIN 01B CMD2 $e^+e^- \rightarrow \eta\gamma$

4.00 ± 0.04 ± 0.11 ⁵ ACHASOV 00 SND $e^+e^- \rightarrow \eta\gamma$

3.53 ± 0.08 ± 0.17 2200 ^{6,7} AKHMETSHIN 99F CMD2 $e^+e^- \rightarrow \eta\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.19 ± 0.06 ⁸ BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

¹ From a combined fit of $\sigma(e^+e^- \rightarrow \eta\gamma)$ with $\eta \rightarrow 3\pi^0$ and $\eta \rightarrow \pi^+\pi^-\pi^0$, and fixing $B(\eta \rightarrow 3\pi^0) / B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.44 \pm 0.04$. Recalculated by us from the cross section at the peak. Supersedes ACHASOV 00D and ACHASOV 06A.

² From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

³ From the $\eta \rightarrow 3\pi^0$ decay and using $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

⁴ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

⁵ From the $\eta \rightarrow 2\gamma$ decay and using $B(\eta \rightarrow 2\gamma) = (39.21 \pm 0.34) \times 10^{-2}$.

⁶ Recalculated by the authors from the cross section in the peak.

⁷ From the $\eta \rightarrow \pi^+\pi^-\pi^0$ decay and using $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.

⁸ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M004G2;LINKAGE=AH

NODE=M004G2;LINKAGE=AK

NODE=M004G;LINKAGE=AK

NODE=M004G;LINKAGE=BQ

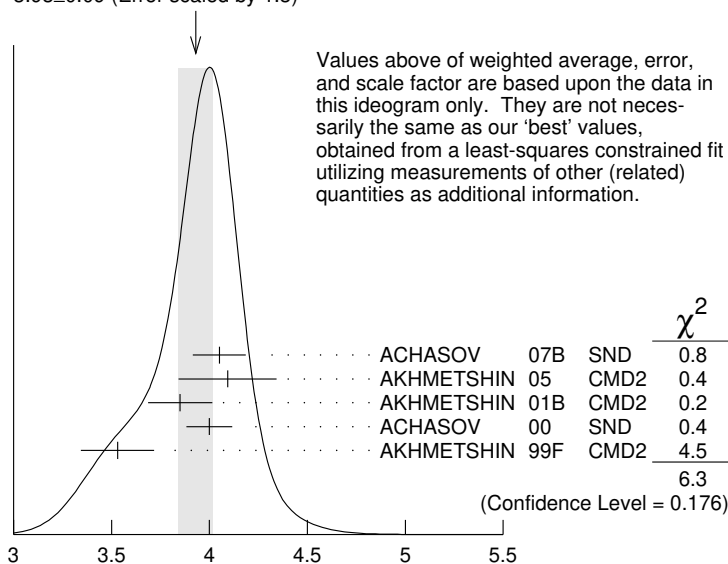
NODE=M004G2;LINKAGE=A

NODE=M004G;LINKAGE=A

NODE=M004G2;LINKAGE=C

NODE=M004G7;LINKAGE=BE

WEIGHTED AVERAGE
3.93±0.09 (Error scaled by 1.3)



$\Gamma(\eta\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_5/\Gamma \times \Gamma_8/\Gamma$

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$

$\Gamma_6/\Gamma \times \Gamma_8/\Gamma$

VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT

3.94 ± 0.16 OUR FIT

3.95 ± 0.17 OUR AVERAGE

4.04 ± 0.09 ± 0.19 ¹ ACHASOV 16A SND 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

3.75 ± 0.11 ± 0.29 18k AKHMETSHIN 05 CMD2 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.29 ± 0.11 ² BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

3.67 ± 0.10^{+0.27}_{-0.25} ³ ACHASOV 00 SND $e^+e^- \rightarrow \pi^0\gamma$

NODE=M004G3

NODE=M004G3

- ¹ From the VMD model with the interfering $\rho(770)$, $\omega(782)$, $\phi(1020)$ resonances, and an additional resonance describing the total contribution of the $\rho(1450)$ and $\omega(1420)$ states. Supersedes ACHASOV 00.
- ² A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.
- ³ From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.

$$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
8.5 $\pm$ 0.6 OUR FIT	Error includes scale factor of 1.2. $[(8.5 \pm 0.6) \times 10^{-8}]$ OUR 2023 FIT		

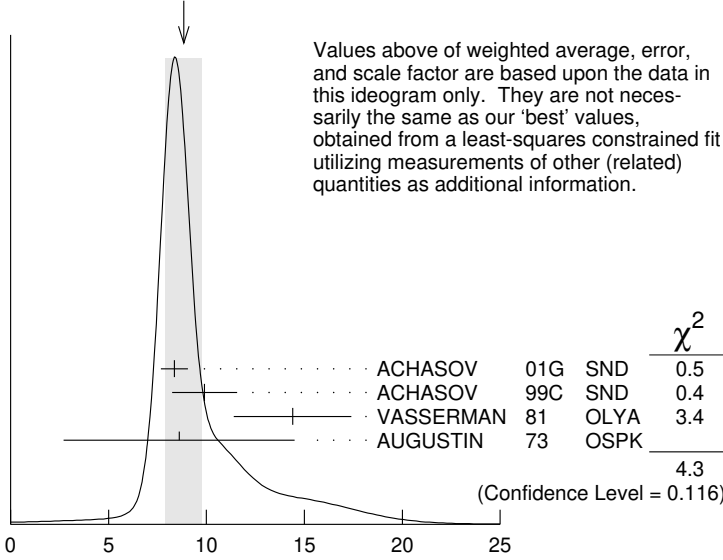
8.8 $\pm$ 0.9 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

8.36 $\pm$ 0.59 $\pm$ 0.37	ACHASOV	01G	SND	$e^+e^- \rightarrow \mu^+\mu^-$
9.9 $\pm$ 1.4 $\pm$ 0.9	¹ ACHASOV	99C	SND	$e^+e^- \rightarrow \mu^+\mu^-$
14.4 $\pm$ 3.0	² VASSERMAN	81	OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
8.6 $\pm$ 5.9	² AUGUSTIN	73	OSPK	$e^+e^- \rightarrow \mu^+\mu^-$

¹ Recalculated by the authors from the cross section in the peak.

² Recalculated by us from the cross section in the peak.

WEIGHTED AVERAGE
8.8 $\pm$ 0.9 (Error scaled by 1.5)



$$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

2.2 $\pm$ 0.4 OUR FIT

2.2 $\pm$ 0.4 OUR AVERAGE

2.1 $\pm$ 0.3 $\pm$ 0.3	¹ ACHASOV	00C	SND	$e^+e^- \rightarrow \pi^+\pi^-$
1.95 $\pm$ 1.15 $\pm$ 0.87	² GOLUBEV	86	ND	$e^+e^- \rightarrow \pi^+\pi^-$
6.01 $\pm$ 3.19 $\pm$ 2.51	² VASSERMAN	81	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.31 $\pm$ 0.99 ³ BENAYOUN 13 RVUE 0.4-1.05 e^+e^-

¹ Recalculated by the authors from the cross section in the peak.

² Recalculated by us from the cross section in the peak.

³ A simultaneous fit to $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma, K\bar{K}$, and $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$ data.

$$\Gamma(\omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

1.40 $\pm$ 0.15 OUR FIT

1.37 $\pm$ 0.17 $\pm$ 0.01 ^{1,2} AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

¹ Recalculated by the authors from the cross section at the peak.

² AMBROSINO 08G reports $[\Gamma(\phi(1020) \rightarrow \omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(\phi(1020) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = (1.22 \pm 0.13 \pm 0.08) \times 10^{-8}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M004G3;LINKAGE=B

NODE=M004G3;LINKAGE=BE
NODE=M004G3;LINKAGE=A

NODE=M004G5
NODE=M004G5

NEW

NODE=M004G5;LINKAGE=A
NODE=M004G5;LINKAGE=B

NODE=M004G4
NODE=M004G4

NODE=M004G4;LINKAGE=AC
NODE=M004G4;LINKAGE=B
NODE=M004G4;LINKAGE=A

NODE=M004G11
NODE=M004G11

NODE=M004G11;LINKAGE=AB
NODE=M004G11;LINKAGE=AM

$$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-8})

DOCUMENT ID

TECN

COMMENT

3.34±0.17 OUR FIT**3.33^{+0.04+0.19}_{-0.09-0.20}**¹ AMBROSINO 07 KLOE $e^+e^- \rightarrow \pi^0\pi^0\gamma$ ¹ Calculated by the authors from the cross section at the peak.NODE=M004G9
NODE=M004G9

NODE=M004G9;LINKAGE=AM

$$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_8/\Gamma$$

VALUE (units 10^{-9})

EVTS

DOCUMENT ID

TECN

COMMENT

1.2^{+0.8}_{-0.7} OUR FIT**1.17±0.52±0.64** 3285 ¹ AKHMETSHIN 00E CMD2 $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$ ¹ Recalculated by the authors from the cross section in the peak.NODE=M004G8
NODE=M004G8

NODE=M004G8;LINKAGE=A

 $\phi(1020)$ BRANCHING RATIOS

$$\Gamma(K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.491±0.005 OUR FIT Error includes scale factor of 1.3. [0.491±0.005 OUR 2023 FIT

Scale factor = 1.3]

0.493±0.010 OUR AVERAGE0.492±0.012 2913 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow K^+K^-$ 0.44 ±0.05 321 KALBFLEISCH 76 HBC $2.18 K^-p \rightarrow \Lambda K^+K^-$ 0.49 ±0.06 270 DEGROOT 74 HBC $4.2 K^-p \rightarrow \Lambda\phi$ 0.540±0.034 565 BALAKIN 71 OSPK $e^+e^- \rightarrow K^+K^-$ 0.48 ±0.04 252 LINDSEY 66 HBC $2.1-2.7 K^-p \rightarrow \Lambda K^+K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.493±0.003±0.007 ¹ AKHMETSHIN 11 CMD2 $1.02 e^+e^- \rightarrow K^+K^-$ 0.476±0.017 1000k ² ACHASOV 01E SND $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$ ¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .² Using $B(\phi \rightarrow e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

NODE=M004220

NODE=M004R1
NODE=M004R1
NEW

NODE=M004R1;LINKAGE=AK

NODE=M004R1;LINKAGE=B2

$$\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.339±0.004 OUR FIT Error includes scale factor of 1.2. [0.339±0.004 OUR 2023 FIT

Scale factor = 1.2]

0.331±0.009 OUR AVERAGE0.335±0.010 40644 AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow K_L^0 K_S^0$ 0.326±0.035 DOLINSKY 91 ND $e^+e^- \rightarrow K_L^0 K_S^0$ 0.310±0.024 DRUZHININ 84 ND $e^+e^- \rightarrow K_L^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.336±0.002±0.006 ¹ AKHMETSHIN 11 CMD2 $1.02 e^+e^- \rightarrow K_S^0 K_L^0$ 0.351±0.013 500k ² ACHASOV 01E SND $e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$ 0.27 ±0.03 133 KALBFLEISCH 76 HBC $2.18 K^-p \rightarrow \Lambda K_L^0 K_S^0$ 0.257±0.030 95 ³ BALAKIN 71 OSPK $e^+e^- \rightarrow K_L^0 K_S^0$ 0.40 ±0.04 167 LINDSEY 66 HBC $2.1-2.7 K^-p \rightarrow \Lambda K_L^0 K_S^0$ ¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .² Using $B(\phi \rightarrow e^+e^-) = (2.93 \pm 0.14) \times 10^{-4}$.³ Balakin error increased by Paul.NODE=M004R2
NODE=M004R2
NEW

NODE=M004R2;LINKAGE=AK

NODE=M004R2;LINKAGE=B2
NODE=M004R2;LINKAGE=01

$$\Gamma(K_L^0 K_S^0)/\Gamma(K^+K^-) \quad \Gamma_2/\Gamma_1$$

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.690±0.014 OUR FIT Error includes scale factor of 1.3. [0.690±0.015 OUR 2023 FIT

Scale factor = 1.3]

0.740±0.031 OUR AVERAGE0.70 ±0.06 2732 BUKIN 78C OLYA $e^+e^- \rightarrow K_L^0 K_S^0$ 0.82 ±0.08 LOSTY 78 HBC $4.2 K^-p \rightarrow \phi \text{ hyperon}$ 0.71 ±0.05 LAVEN 77 HBC $10 K^-p \rightarrow K^+K^-\Lambda$ 0.71 ±0.08 LYONS 77 HBC $3-4 K^-p \rightarrow \Lambda\phi$ 0.89 ±0.10 144 AGUILAR-... 72B HBC $3.9, 4.6 K^-p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.638±0.022 2.3M ¹ KOZYREV 18 CMD3 $e^+e^- \rightarrow K_L^0 K_S^0$ 0.68 ±0.03 ² AKHMETSHIN 95 CMD2 $e^+e^- \rightarrow K^+K^-, K_L^0 K_S^0, K^+K^-$ NODE=M004R19
NODE=M004R19
NEW

- ¹ The prediction taking into account phase-space difference, radiative corrections, isospin breaking, and the Sommerfeld-Gamow-Sakharov factor gives 0.630.
- ² Theoretical analysis of BRAMON 00 taking into account phase-space difference, electromagnetic radiative corrections, as well as isospin breaking, predicts 0.62. FLOREZ-BAEZ 08 predicts 0.63 considering also structure-dependent radiative corrections. FIS-CHBACH 02 calculates additional corrections caused by the close threshold and predicts 0.68. See also BENAYOUN 01 and DUBYNSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

$$\Gamma(K_L^0 K_S^0)/\Gamma(K\bar{K})$$

$$\Gamma_2/(\Gamma_1+\Gamma_2)$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.408±0.005 OUR FIT	Error includes scale factor of 1.3. [0.408 ± 0.005 OUR 2023 FIT Scale factor = 1.3]			
0.45 ±0.04 OUR AVERAGE				

0.44 ±0.07		¹ LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda K \bar{K}$
0.48 ±0.07	52	BADIER	65B	HBC	3 $K^- p$
0.40 ±0.10	34	SCHLEIN	63	HBC	1.95 $K^- p \rightarrow \Lambda K \bar{K}$

- ¹ This is probably not affected by their controversial background subtraction; the value is from their numbers of $K_1 K_2$ vs $K^+ K^-$ events.

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.154±0.004 OUR FIT	Error includes scale factor of 1.2.			
0.151±0.009 OUR AVERAGE	Error includes scale factor of 1.7.			

0.161±0.008	11761	AKHMETSHIN 95	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.143±0.007		DOLINSKY 91	ND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.155±0.002±0.005		¹ AKHMETSHIN 11	CMD2	1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.159±0.008	400k	² ACHASOV 01E	SND	$e^+ e^- \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0$
0.145±0.009±0.003	11169	³ AKHMETSHIN 98	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.139±0.007		⁴ PARROUR 76B	OSPK	$e^+ e^-$

- ¹ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+ K^-, K_S^0 K_L^0, \pi^+ \pi^- \pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

- ² Using $B(\phi \rightarrow e^+ e^-) = (2.93 \pm 0.14) \times 10^{-4}$.

- ³ Using $B(\phi \rightarrow e^+ e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

- ⁴ Using $\Gamma(\phi) = 4.1$ MeV. If interference between the $\rho\pi$ and 3π modes is neglected, the fraction of the $\rho\pi$ is more than 80% at the 90% confidence level.

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K^+ K^-)$$

$$\Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.313±0.010 OUR FIT	Error includes scale factor of 1.2.			
0.28 ±0.09	34	AGUILAR-...	72B	HBC 3.9,4.6 $K^- p$

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K\bar{K})$$

$$\Gamma_3/(\Gamma_1+\Gamma_2)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.185±0.005 OUR FIT	Error includes scale factor of 1.2.		
0.24 ±0.04 OUR AVERAGE			

0.237±0.039	CERRADA	77B	HBC	4.2 $K^- p \rightarrow \Lambda 3\pi$
0.30 ±0.15	LONDON	66	HBC	2.24 $K^- p \rightarrow \Lambda \pi^+ \pi^- \pi^0$

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K_L^0 K_S^0)$$

$$\Gamma_3/\Gamma_2$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.453±0.012 OUR FIT	Error includes scale factor of 1.1.			
0.51 ±0.05 OUR AVERAGE				

0.56 ±0.07	3681	BUKIN	78C	OLYA $e^+ e^- \rightarrow K_L^0 K_S^0, \pi^+ \pi^- \pi^0$
0.47 ±0.06	516	COSME	74	OSPK $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

$$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

- • • We do not use the following data for averages, fits, limits, etc. • • •

≈ 0.0087	1.98M	^{1,2} ALOISIO	03	KLOE	1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
<0.0006	90	³ ACHASOV	02	SND	1.02 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
<0.23	90	³ CORDIER	80	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
<0.20	90	³ PARROUR	76B	OSPK	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

- ¹ From a fit without limitations on charged and neutral ρ masses and widths.

- ² Adding the direct and $\omega\pi$ contributions and considering the interference between the $\rho\pi$ and $\pi^+ \pi^- \pi^0$.

- ³ Neglecting the interference between the $\rho\pi$ and $\pi^+ \pi^- \pi^0$.

NODE=M004R19;LINKAGE=A

NODE=M004R19;LINKAGE=KH

NODE=M004R5
NODE=M004R5
NEW

NODE=M004R5;LINKAGE=01

NODE=M004R3
NODE=M004R3

NODE=M004R3;LINKAGE=AK

NODE=M004R3;LINKAGE=B2

NODE=M004R;LINKAGE=8D

NODE=M004R3;LINKAGE=E

NODE=M004R20
NODE=M004R20

NODE=M004R6
NODE=M004R6

NODE=M004R7
NODE=M004R7

NODE=M004R46
NODE=M004R46

NODE=M004R;LINKAGE=L1

NODE=M004R;LINKAGE=L2

NODE=M004R;LINKAGE=46

$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

1.301 ± 0.024 OUR FIT Error includes scale factor of 1.2. $[(1.301 \pm 0.025) \times 10^{-2} \text{ OUR 2023 FIT Scale factor} = 1.2]$

1.26 ± 0.04 OUR AVERAGE

1.246 ± 0.025 ± 0.057	10k	¹ ACHASOV	98F	SND	$e^+e^- \rightarrow 7\gamma$
1.18 ± 0.11	279	² AKHMETSHIN	95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
1.30 ± 0.06		³ DRUZHININ	84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 ± 0.2		⁴ DRUZHININ	84	ND	$e^+e^- \rightarrow 6\gamma$
0.88 ± 0.20	290	KURDADZE	83C	OLYA	$e^+e^- \rightarrow 3\gamma$
1.35 ± 0.29		ANDREWS	77	CNTR	6.7–10 γ Cu
1.5 ± 0.4	54	³ COSME	76	OSPK	e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.38 ± 0.02 ± 0.02		⁵ AKHMETSHIN	11	CMD2	$1.02 e^+e^- \rightarrow \eta\gamma$
1.36 ± 0.05 ± 0.01	33k	⁶ ACHASOV	07B	SND	$0.6\text{--}1.38 e^+e^- \rightarrow \eta\gamma$
1.373 ± 0.014 ± 0.085	17.4k	^{7,8} AKHMETSHIN	05	CMD2	$0.60\text{--}1.38 e^+e^- \rightarrow \eta\gamma$
1.287 ± 0.013 ± 0.063		^{9,10} AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.338 ± 0.012 ± 0.052		¹¹ ACHASOV	00	SND	$e^+e^- \rightarrow \eta\gamma$
1.18 ± 0.03 ± 0.06	2200	¹² AKHMETSHIN	99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.21 ± 0.07		¹³ BENAYOUN	96	RVUE	$0.54\text{--}1.04 e^+e^- \rightarrow \eta\gamma$

¹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.2 \pm 0.4) \times 10^{-2}$.

² From $\pi^+\pi^-\pi^0$ decay mode of η .

³ From 2γ decay mode of η .

⁴ From $3\pi^0$ decay mode of η .

⁵ Combined analysis of the CMD-2 data on $\phi \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0, \eta\gamma$ assuming that the sum of their branching fractions is 0.99741 ± 0.00007 .

⁶ ACHASOV 07B reports $[\Gamma(\phi(1020) \rightarrow \eta\gamma)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow e^+e^-)] = (4.050 \pm 0.067 \pm 0.118) \times 10^{-6}$ which we divide by our best value $B(\phi(1020) \rightarrow e^+e^-) = (2.979 \pm 0.033) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Supersedes ACHASOV 00D and ACHASOV 06A.

⁷ Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$ and $B(\eta \rightarrow \gamma\gamma) = 39.43 \pm 0.26\%$.

⁸ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\eta\gamma)/\Gamma_{\text{total}}^2$.

⁹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$ and $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$.

¹⁰ The combined fit from 600 to 1380 MeV taking into account $\rho(770)$, $\omega(782)$, $\phi(1020)$, and $\rho(1450)$ (mass and width fixed at 1450 MeV and 310 MeV respectively).

¹¹ From the $\eta \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

¹² From $\pi^+\pi^-\pi^0$ decay mode of η and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

¹³ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

NODE=M004R11
NODE=M004R11

NEW

OCCUR=2

NODE=M004R11;LINKAGE=AC
NODE=M004R11;LINKAGE=Z3
NODE=M004R11;LINKAGE=A
NODE=M004R11;LINKAGE=C
NODE=M004R11;LINKAGE=AN

NODE=M004R11;LINKAGE=AO

NODE=M004R11;LINKAGE=AH
NODE=M004R11;LINKAGE=AK
NODE=M004R;LINKAGE=AK
NODE=M004R;LINKAGE=BQ

NODE=M004R;LINKAGE=GA
NODE=M004R;LINKAGE=FF
NODE=M004R;LINKAGE=TS

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.32 ± 0.05 OUR FIT**1.31 ± 0.13 OUR AVERAGE**

1.30 ± 0.13		DRUZHININ	84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 ± 0.5	32	COSME	76	OSPK	e^+e^-
1.367 ± 0.072		¹ ACHASOV	16A	SND	$0.60\text{--}1.38 e^+e^- \rightarrow \pi^0\gamma$
1.258 ± 0.037 ± 0.077	18k	^{2,3} AKHMETSHIN	05	CMD2	$0.60\text{--}1.38 e^+e^- \rightarrow \pi^0\gamma$
1.226 ± 0.036 ^{+0.096} _{-0.089}		⁴ ACHASOV	00	SND	$e^+e^- \rightarrow \pi^0\gamma$
1.26 ± 0.17		⁵ BENAYOUN	96	RVUE	$0.54\text{--}1.04 e^+e^- \rightarrow \pi^0\gamma$

¹ Using $B(\phi \rightarrow e^+e^-)$ from PDG 15. Supersedes ACHASOV 00.

² Using $B(\phi \rightarrow e^+e^-) = (2.98 \pm 0.04) \times 10^{-4}$.

³ Not independent of the corresponding $\Gamma(e^+e^-) \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}^2$.

⁴ From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁵ Reanalysis of DRUZHININ 84, DOLINSKY 89, and DOLINSKY 91 taking into account a triangle anomaly contribution.

OCCUR=3

NODE=M004R17;LINKAGE=D
NODE=M004R17;LINKAGE=AH
NODE=M004R17;LINKAGE=AK
NODE=M004R;LINKAGE=3G
NODE=M004R17;LINKAGE=TS

 $\Gamma(\eta\gamma)/\Gamma(\pi^0\gamma)$ Γ_5/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.9 ± 0.3 ^{+0.7} _{-0.8}	ACHASOV	00	SND	$e^+e^- \rightarrow \eta\gamma, \pi^0\gamma$

NODE=M004R42
NODE=M004R42

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.979 ± 0.033 OUR FIT Error includes scale factor of 1.2. $[(2.979 \pm 0.033) \times 10^{-4}]$ OUR 2023 FIT Scale factor = 1.3]				
2.98 ± 0.07 OUR AVERAGE Error includes scale factor of 1.1.				
2.93 ± 0.14	1900k	¹ ACHASOV	01E SND	$e^+e^- \rightarrow K^+K^-, K_S^0 K_L^0, \pi^+\pi^-\pi^0$
2.88 ± 0.09	55600	AKHMETSHIN	95 CMD2	$e^+e^- \rightarrow \text{hadrons}$
3.00 ± 0.21	3681	BUKIN	78C OLYA	$e^+e^- \rightarrow \text{hadrons}$
3.10 ± 0.14		² PARROUR	76 OSPK	e^+e^-
3.3 ± 0.3		COSME	74 OSPK	$e^+e^- \rightarrow \text{hadrons}$
2.81 ± 0.25	681	BALAKIN	71 OSPK	$e^+e^- \rightarrow \text{hadrons}$
3.50 ± 0.27		CHATELUS	71 OSPK	e^+e^-

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of K^+K^- , $K_S^0 K_L^0$, $\pi^+\pi^-\pi^0$, and $\eta\gamma$ decays modes and using ACHASOV 00B for the $\eta\gamma$ decay mode.

² Using total width 4.2 MeV. They detect 3π mode and observe significant interference with ω tail. This is accounted for in the result quoted above.

NODE=M004R16
NODE=M004R16

NEW

NODE=M004R16;LINKAGE=AE

NODE=M004R16;LINKAGE=E

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.85 ± 0.22 OUR FIT Error includes scale factor of 1.2. $[(2.85 \pm 0.19) \times 10^{-4}]$ OUR 2023 FIT]			
2.5 ± 0.4 OUR AVERAGE			
2.69 ± 0.46	¹ HAYES	71 CNTR	$8.3, 9.8 \gamma C \rightarrow \mu^+\mu^- X$
2.17 ± 0.60	¹ EARLES	70 CNTR	$6.0 \gamma C \rightarrow \mu^+\mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.87 ± 0.20 ± 0.14	² ACHASOV	01G SND	$e^+e^- \rightarrow \mu^+\mu^-$
3.30 ± 0.45 ± 0.32	³ ACHASOV	99C SND	$e^+e^- \rightarrow \mu^+\mu^-$
4.83 ± 1.02	⁴ VASSERMAN	81 OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
2.87 ± 1.98	⁴ AUGUSTIN	73 OSPK	$e^+e^- \rightarrow \mu^+\mu^-$

¹ Neglecting interference between resonance and continuum.

² Using $B(\phi \rightarrow e^+e^-) = (2.91 \pm 0.07) \times 10^{-4}$.

³ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

⁴ Recalculated by us using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

NODE=M004R10
NODE=M004R10

NEW

NODE=M004R10;LINKAGE=A
NODE=M004R;LINKAGE=GZ
NODE=M004R10;LINKAGE=8D
NODE=M004R;LINKAGE=VA

 $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.08 ± 0.04 OUR AVERAGE				
1.075 ± 0.007 ± 0.038	30k	¹ BABUSCI	15 KLOE	$1.02 e^+e^- \rightarrow \eta e^+e^-$
1.19 ± 0.19 ± 0.12	213	² ACHASOV	01B SND	$e^+e^- \rightarrow \eta e^+e^-$
1.14 ± 0.10 ± 0.06	355	³ AKHMETSHIN	01 CMD2	$e^+e^- \rightarrow \eta e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.13 ± 0.14 ± 0.07	183	⁴ AKHMETSHIN	01 CMD2	$e^+e^- \rightarrow \eta e^+e^-$
1.21 ± 0.14 ± 0.09	130	⁵ AKHMETSHIN	01 CMD2	$e^+e^- \rightarrow \eta e^+e^-$
1.04 ± 0.20 ± 0.08	42	⁶ AKHMETSHIN	01 CMD2	$e^+e^- \rightarrow \eta e^+e^-$
1.3 ^{+0.8} _{-0.6}	7	GOLUBEV	85 ND	$e^+e^- \rightarrow \eta e^+e^-$

¹ Using $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.23)\%$ from PDG 12.

² Using $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.32)\%$, $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06)\%$, and $B(\phi \rightarrow e^+e^-) = (3.00 \pm 0.06) \times 10^{-4}$.

³ The average of the branching ratios separately obtained from the $\eta \rightarrow \gamma\gamma$, $3\pi^0$, $\pi^+\pi^-\pi^0$ decays.

⁴ From $\eta \rightarrow \gamma\gamma$ decays and using $B(\eta \rightarrow \gamma\gamma) = (39.33 \pm 0.25) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

⁵ From $\eta \rightarrow 3\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\eta \rightarrow 3\pi^0) = (32.24 \pm 0.29) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

⁶ From $\eta \rightarrow \pi^+\pi^-\pi^0$ decays and using $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \rightarrow e^+e^-\gamma) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \rightarrow \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, and $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$.

NODE=M004R24
NODE=M004R24

OCCUR=2
OCCUR=3
OCCUR=4

NODE=M004R24;LINKAGE=A
NODE=M004R;LINKAGE=VM

NODE=M004R;LINKAGE=H1

NODE=M004R;LINKAGE=H2

NODE=M004R;LINKAGE=H3

NODE=M004R;LINKAGE=H4

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.71 \pm 0.11 \pm 0.09$		¹ ACHASOV	00C	SND	$e^+e^- \rightarrow \pi^+\pi^-$
$0.65^{+0.38}_{-0.29}$		¹ GOLUBEV	86	ND	$e^+e^- \rightarrow \pi^+\pi^-$
$2.01^{+1.07}_{-0.84}$		¹ VASSERMAN	81	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
<6.6	95	BUKIN	78B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-$
<2.7	95	ALVENSLEB...	72	CNTR	$6.7 \gamma C \rightarrow C\pi^+\pi^-$

¹ Using $B(\phi \rightarrow e^+e^-) = (2.99 \pm 0.08) \times 10^{-4}$.

NODE=M004R18
NODE=M004R18

NODE=M004R18;LINKAGE=8D

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

4.7±0.5 OUR FIT

**5.2±1.3
-1.1**

^{1,2} AULCHENKO 00A SND $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.4 ± 0.6		³ AMBROSINO	08G	KLOE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$
~ 5.4		⁴ ACHASOV	00E	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$5.5^{+1.6}_{-1.4} \pm 0.3$		^{2,5} AULCHENKO	00A	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
$4.8^{+1.9}_{-1.7} \pm 0.8$		⁴ ACHASOV	99	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$

¹ Using the 1996 and 1998 data.

² $(2.3 \pm 0.3)\%$ correction for other decay modes of the $\omega(782)$ applied.

³ Not independent of the corresponding $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-) / \Gamma^2(\text{total})$.

⁴ Using the 1996 data.

⁵ Using the 1998 data.

NODE=M004R28
NODE=M004R28

OCCUR=2

NODE=M004R28;LINKAGE=K2
NODE=M004R28;LINKAGE=K3
NODE=M004R28;LINKAGE=AM
NODE=M004R28;LINKAGE=VS
NODE=M004R28;LINKAGE=K1

 $\Gamma(\omega\gamma)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.05 84 LINDSEY 66 HBC $2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

NODE=M004R14
NODE=M004R14

 $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 0.12 90 ¹ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 7	90	AKHMETSHIN 97C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<200	84	LINDSEY 66	HBC	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

¹ Supersedes AKHMETSHIN 97C.

NODE=M004R15
NODE=M004R15

NODE=M004R;LINKAGE=1N

 $\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.41±0.12±0.04 30175 ¹ AKHMETSHIN 99B CMD2 $e^+e^- \rightarrow \pi^+\pi^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.3	90	² AKHMETSHIN 97C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<600	90	KALBFLEISCH 75	HBC	$2.18 K^-p \rightarrow \Lambda\pi^+\pi^-\gamma$
< 70	90	COSME 74	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<400	90	LINDSEY 65	HBC	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^- \text{ neutrals}$

¹ For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible. Supersedes AKHMETSHIN 97C.

² For $E_\gamma > 20$ MeV and assuming that $B(\phi(1020) \rightarrow f_0(980)\gamma)$ is negligible.

NODE=M004R12
NODE=M004R12

NODE=M004R;LINKAGE=2N

NODE=M004R12;LINKAGE=Z3

 $\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

3.22±0.19 OUR FIT Error includes scale factor of 1.1.

3.21±0.19 OUR AVERAGE

$3.21^{+0.03}_{-0.09} \pm 0.18$		¹ AMBROSINO 07	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
$2.90 \pm 0.21 \pm 1.54$		² AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma, \pi^0\pi^0\gamma$

NODE=M004R30
NODE=M004R30

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.47±0.21	2438	³ ALOISIO	02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
3.5 ±0.3 ^{+1.3} _{-0.5}	419	^{4,5} ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.93±0.46±0.50	27188	⁶ AKHMETSHIN 99B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$	
3.05±0.25±0.72	268	⁷ AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
1.5 ±0.5	268	⁸ AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
3.42±0.30±0.36	164	⁴ ACHASOV 98I	SND	$e^+e^- \rightarrow 5\gamma$	
< 1	90	⁹ AKHMETSHIN 97C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$	
< 7	90	¹⁰ AKHMETSHIN 97C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$	
< 20	90	DRUZHININ 87	ND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	

OCCUR=2

OCCUR=2

¹ Obtained by the authors taking into account the $\pi^+\pi^-$ decay mode. Includes a component due to $\pi\pi$ production via the $f_0(500)$ meson. Supersedes ALOISIO 02D.

² From the combined fit of the photon spectra in the reactions $e^+e^- \rightarrow \pi^+\pi^-\gamma$, $\pi^0\pi^0\gamma$.

³ From the negative interference with the $f_0(500)$ meson of AITALA 01B using the ACHASOV 89 parameterization for the $f_0(980)$, a Breit-Wigner for the $f_0(500)$, and ACHASOV 01F for the $\rho\pi$ contribution. Superseded by AMBROSINO 07.

⁴ Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $B(\phi \rightarrow K\bar{K}\gamma)$ and using $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.

⁵ Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.

⁶ For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.

⁷ Neglecting other intermediate mechanisms ($\rho\pi$, $\sigma\gamma$).

⁸ A narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.

⁹ For destructive interference with the Bremsstrahlung process

¹⁰ For constructive interference with the Bremsstrahlung process

NODE=M004R30;LINKAGE=MB

NODE=M004R;LINKAGE=SL

NODE=M004R;LINKAGE=KD

NODE=M004R;LINKAGE=AI

NODE=M004R;LINKAGE=U8

NODE=M004R;LINKAGE=3N

NODE=M004R;LINKAGE=SM

NODE=M004R;LINKAGE=ST

NODE=M004R30;LINKAGE=A

NODE=M004R30;LINKAGE=B

$\Gamma(f_0(980)\gamma)/\Gamma(\eta\gamma)$

 Γ_{16}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

2.48±0.15 OUR FIT Error includes scale factor of 1.1.

2.6 ±0.2 ^{+0.8}_{-0.3}	419	¹ ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ Assuming that the $\pi^0\pi^0\gamma$ final state is completely determined by the $f_0\gamma$ mechanism, neglecting the decay $B(\phi \rightarrow K\bar{K}\gamma)$ and using $B(f_0 \rightarrow \pi^+\pi^-) = 2B(f_0 \rightarrow \pi^0\pi^0)$.

NODE=M004R44
NODE=M004R44

NODE=M004R44;LINKAGE=AI

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$

 Γ_{17}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.07 ±0.06 OUR AVERAGE

1.07 ^{+0.01} _{-0.03} ^{+0.06} _{-0.06}		¹ AMBROSINO 07	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.08 ±0.17 ±0.09	268	AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.09 ±0.03 ±0.05	2438	ALOISIO	02D	KLOE	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

1.158±0.093±0.052	419	^{2,3} ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

<10	90	DRUZHININ 87	ND	$e^+e^- \rightarrow 5\gamma$

¹ Supersedes ALOISIO 02D.

² Using the value $B(\phi \rightarrow \eta\gamma) = (1.338 \pm 0.053) \times 10^{-2}$.

³ Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.

NODE=M004R26
NODE=M004R26

NODE=M004R26;LINKAGE=MB

NODE=M004R26;LINKAGE=U8

NODE=M004R26;LINKAGE=V8

$\Gamma(\pi^0\pi^0\gamma)/\Gamma(\eta\gamma)$

 Γ_{17}/Γ_5

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

0.86 ±0.04 OUR FIT

0.865±0.070±0.017	419	¹ ACHASOV	00H	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.90 ±0.08 ±0.07	164	ACHASOV	98I	SND	$e^+e^- \rightarrow 5\gamma$

¹ Supersedes ACHASOV 98I. Excluding $\omega\pi^0$.

NODE=M004R39
NODE=M004R39

NODE=M004R39;LINKAGE=V8

$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}}$

 Γ_{18}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

6.5 ±2.7 ±1.6	6.8k	¹ AKHMETSHIN 17	CMD3	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.93±1.74±2.14	3.3k	AKHMETSHIN 00E	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

< 870	90	CORDIER 79	WIRE	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-$

¹ Using the cross section at the ϕ meson peak $\sigma(\phi) = 4172 \pm 42$ nb, the nonresonant cross section $\sigma(0) = 1.263 \pm 0.027$ nb and $\text{Re}(Z) = 0.146 \pm 0.030$, $\text{Im}(Z) = -0.002 \pm 0.024$ for the complex amplitude of the $\phi \rightarrow \pi^+\pi^-\pi^+\pi^-$ transition.

NODE=M004R22
NODE=M004R22

NODE=M004R22;LINKAGE=A

$\Gamma(\pi^+\pi^+\pi^-\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.6	90	AKHMETSHIN 00E	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<150	95	BARKOV	88	CMD $e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$

NODE=M004R27
NODE=M004R27

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.33^{+0.07}_{-0.10} OUR AVERAGE

1.35 ± 0.05 ^{+0.05} _{-0.10}	9.5k	¹ ANASTASI	16B	KLOE	$e^+e^- \rightarrow \pi^0 e^+ e^-$
1.01 ± 0.28 ± 0.29	52	² ACHASOV	02D	SND	$e^+e^- \rightarrow \pi^0 e^+ e^-$
1.22 ± 0.34 ± 0.21	46	³ AKHMETSHIN	01C	CMD2	$e^+e^- \rightarrow \pi^0 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12	90	DOLINSKY	88	ND	$e^+e^- \rightarrow \pi^0 e^+ e^-$

NODE=M004R31
NODE=M004R31

¹ Using $B(\pi^0 \rightarrow \gamma\gamma)$ from the 2014 Edition of this Review (PDG 14).

² Using various branching ratios from the 2000 Edition of this Review (PDG 00).

³ Using $B(\pi^0 \rightarrow \gamma\gamma) = 0.98798 \pm 0.00032$, $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033) \times 10^{-2}$, and $B(\eta \rightarrow \pi^+\pi^-\gamma) = (4.75 \pm 0.11) \times 10^{-2}$.

NODE=M004R31;LINKAGE=A
NODE=M004R;LINKAGE=DS
NODE=M004R;LINKAGE=5H

 $\Gamma(\pi^0 \eta\gamma)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

7.27 ± 0.30 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

7.06 ± 0.22	16.9k	¹ AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.51 ± 0.51 ± 0.57	607	² ALOISIO	02C	KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
7.96 ± 0.60 ± 0.40	197	³ ALOISIO	02C	KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8 ± 1.4 ± 0.9	36	⁴ ACHASOV	00F	SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
9.0 ± 2.4 ± 1.0	80	AKHMETSHIN	99C	CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.01 ± 0.10 ± 0.20	13.3k	^{2,5} AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
7.12 ± 0.13 ± 0.22	3.6k	^{3,6} AMBROSINO	09F	KLOE	$1.02 e^+e^- \rightarrow \eta\pi^0\gamma$
8.3 ± 2.3 ± 1.2	20	ACHASOV	98B	SND	$e^+e^- \rightarrow 5\gamma$
<250	90	DOLINSKY	91	ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

NODE=M004R32
NODE=M004R32

OCCUR=2

OCCUR=2

OCCUR=3

¹ Combined results of $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decay modes measurements.

² From the decay mode $\eta \rightarrow \gamma\gamma$.

³ From the decay mode $\eta \rightarrow \pi^+\pi^-\pi^0$.

⁴ Supersedes ACHASOV 98B.

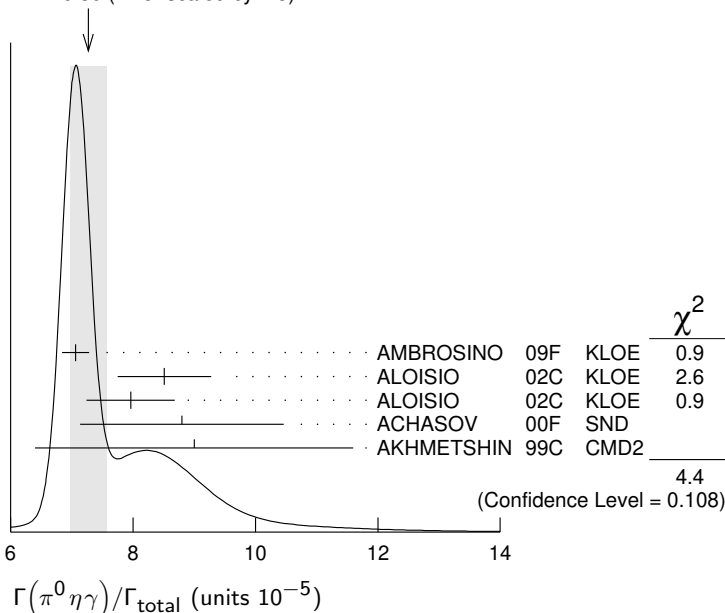
⁵ Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.

⁶ Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (22.73 \pm 0.28)\%$.

NODE=M004R32;LINKAGE=AM
NODE=M004R;LINKAGE=C1
NODE=M004R;LINKAGE=C2
NODE=M004R32;LINKAGE=AF
NODE=M004R32;LINKAGE=AB

NODE=M004R32;LINKAGE=AR

WEIGHTED AVERAGE
7.27 ± 0.30 (Error scaled by 1.5)



$\Gamma(a_0(980)\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.6±0.6 OUR FIT					
7.6±0.6 OUR AVERAGE					
7.4±0.7			¹ ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
8.8±1.7	36		² ACHASOV	00F SND	$e^+e^- \rightarrow \eta\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11 ±2			³ GOKALP	02 RVUE	$e^+e^- \rightarrow \eta\pi^0\gamma$
<500	90		DOLINSKY	91 ND	$e^+e^- \rightarrow \pi^0\eta\gamma$

¹ Using $M_{a_0(980)}=984.8$ MeV and assuming $a_0(980)\gamma$ dominance.

² Assuming $a_0(980)\gamma$ dominance in the $\eta\pi^0\gamma$ final state.

³ Using data of ACHASOV 00F.

NODE=M004R33
NODE=M004R33

NODE=M004R;LINKAGE=C3
NODE=M004R33;LINKAGE=AF
NODE=M004R;LINKAGE=GK

 $\Gamma(f_0(980)\gamma)/\Gamma(a_0(980)\gamma)$

VALUE	DOCUMENT ID	TECN	COMMENT
6.1±0.6	¹ ALOISIO	02C KLOE	$e^+e^- \rightarrow \eta\pi^0\gamma$
¹ Using results of ALOISIO 02D and assuming that $f_0(980)$ decays into $\pi\pi$ only and $a_0(980)$ into $\eta\pi$ only.			

NODE=M004R47
NODE=M004R47

NODE=M004R;LINKAGE=C4

 $\Gamma(K^0\bar{K}^0\gamma)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.9 × 10⁻⁸	90	AMBROSINO	09C KLOE	$e^+e^- \rightarrow K_S^0 K_S^0 \gamma$

NODE=M004R48
NODE=M004R48

 $\Gamma(\eta'(958)\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.21±0.20 OUR FIT					
[(6.21 ± 0.21) × 10 ⁻⁵ OUR 2023 FIT]					
6.21±0.29 OUR AVERAGE					
[(6.21 ± 0.30) × 10 ⁻⁵ OUR 2023 AVERAGE]					
6.21±0.27±0.11	3407		¹ AMBROSINO	07A KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
6.7 ^{+2.8} _{-2.4} ±0.8	12		² AULCHENKO	03B SND	$e^+e^- \rightarrow \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.7 ^{+5.0} _{-4.2} ±1.5	7		AULCHENKO	03B SND	$e^+e^- \rightarrow 7\gamma$
6.10±0.61±0.43	120		³ ALOISIO	02E KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
8.2 ^{+2.1} _{-1.9} ±1.1	21		⁴ AKHMETSHIN	00B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
4.9 ^{+2.2} _{-1.8} ±0.6	9		⁵ AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^+\pi^-\geq 2\gamma$
6.4 ±1.6	30		⁶ AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
6.7 ^{+3.4} _{-2.9} ±1.0	5		⁷ AULCHENKO	99 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
<11	90		AULCHENKO	98 SND	$e^+e^- \rightarrow 7\gamma$
12 ⁺⁷ ₋₅ ±2	6		⁴ AKHMETSHIN	97B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$
<41	90		DRUZHININ	87 ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

¹ AMBROSINO 07A reports $[\Gamma(\phi(1020) \rightarrow \eta'(958)\gamma)/\Gamma_{\text{total}}] / [B(\phi(1020) \rightarrow \eta\gamma)] = (4.77 \pm 0.09 \pm 0.19) \times 10^{-3}$ which we multiply by our best value $B(\phi(1020) \rightarrow \eta\gamma) = (1.301 \pm 0.024) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Averaging AULCHENKO 03B with AULCHENKO 99.

³ Using $B(\phi \rightarrow \eta\gamma) = (1.297 \pm 0.033)\%$.

⁴ Using the value $B(\phi \rightarrow \eta\gamma) = (1.26 \pm 0.06) \times 10^{-2}$.

⁵ Using $B(\phi \rightarrow K_L^0 K_S^0) = (33.8 \pm 0.6)\%$.

⁶ Averaging AKHMETSHIN 00B with AKHMETSHIN 00F.

⁷ Using the value $B(\eta' \rightarrow \eta\pi^+\pi^-) = (43.7 \pm 1.5) \times 10^{-2}$ and $B(\eta \rightarrow \gamma\gamma) = (39.25 \pm 0.31) \times 10^{-2}$.

NODE=M004R25
NODE=M004R25

NEW

NEW

OCCUR=2

OCCUR=2

NODE=M004R25;LINKAGE=AM

NODE=M004R25;LINKAGE=BK
NODE=M004R;LINKAGE=E2
NODE=M004R25;LINKAGE=Q
NODE=M004R;LINKAGE=T2
NODE=M004R;LINKAGE=T3
NODE=M004R25;LINKAGE=AU

 $\Gamma(\eta'(958)\gamma)/\Gamma(K_L^0 K_S^0)$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.83±0.06 OUR FIT				
1.46^{+0.64}_{-0.54} ±0.18	9	¹ AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^-\geq 2\gamma$

¹ Using various branching ratios of K_S^0 , K_L^0 , η , η' from the 2000 edition (The European Physical Journal **C15** 1 (2000)) of this Review.

NODE=M004R43
NODE=M004R43

NODE=M004R;LINKAGE=T1

$\Gamma(\eta'(958)\gamma)/\Gamma(\eta\gamma)$ Γ_{24}/Γ_5 VALUE (units 10^{-3}) EVTS

DOCUMENT ID TECN COMMENT

4.77±0.15 OUR FIT**4.78±0.20 OUR AVERAGE**

4.77±0.09±0.19	3407	AMBROSINO	07A	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-7\gamma$
4.70±0.47±0.31	120	¹ ALOISIO	02E	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-3\gamma$
6.5 $^{+1.7}_{-1.5}$ ±0.8	21	AKHMETSHIN	00B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.5 $^{+5.2}_{-4.0}$ ±1.4	6	² AKHMETSHIN	97B	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$

¹ From the decay mode $\eta' \rightarrow \eta\pi^+\pi^-$, $\eta \rightarrow \gamma\gamma$.² Superseded by AKHMETSHIN 00B.NODE=M004R34
NODE=M004R34NODE=M004R;LINKAGE=E1
NODE=M004R;LINKAGE=KS $\Gamma(\eta\pi^0\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID TECN COMMENT

<2	90	AULCHENKO	98	SND	$e^+e^- \rightarrow 7\gamma$

NODE=M004R36
NODE=M004R36 $\Gamma(\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

1.43±0.45±0.14	27188	¹ AKHMETSHIN	99B	CMD2	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ±1.0	824 ± 33	² AKHMETSHIN	97C	CMD2	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

¹ For $E_\gamma > 20$ MeV. Supersedes AKHMETSHIN 97C.² For $E_\gamma > 20$ MeV.NODE=M004R35
NODE=M004R35NODE=M004R35;LINKAGE=3N
NODE=M004R35;LINKAGE=A $\Gamma(\rho\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ VALUE (units 10^{-4}) CL%

DOCUMENT ID TECN COMMENT

<1.2	90	AULCHENKO	08	CMD2	$\phi \rightarrow \pi^+\pi^-\gamma\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5	90	AKHMETSHIN	98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$

NODE=M004R37
NODE=M004R37 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ VALUE (units 10^{-5}) CL%

DOCUMENT ID TECN COMMENT

< 1.8	90	AKHMETSHIN	00E	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6.1	90	AULCHENKO	08	CMD2	$\phi \rightarrow \eta\pi^+\pi^-$

<30	90	AKHMETSHIN	98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$

NODE=M004R38
NODE=M004R38 $\Gamma(\eta\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ VALUE (units 10^{-6}) CL%

DOCUMENT ID TECN COMMENT

<9.4	90	AKHMETSHIN	01	CMD2	$e^+e^- \rightarrow \eta e^+e^-$

NODE=M004R45
NODE=M004R45 $\Gamma(\eta U \rightarrow \eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE CL%

DOCUMENT ID TECN COMMENT

<1 × 10 ⁻⁶	90	¹ BABUSCI	13B	KLOE	1.02 $e^+e^- \rightarrow \eta e^+e^-$

¹ For a narrow vector U with mass between 5 and 470 MeV, from the combined analysis of $\eta \rightarrow \pi^+\pi^-\pi^0$ and $\eta \rightarrow \pi^0\pi^0\pi^0$ from ARCHILLI 12. Measured 90% CL limits as a function of m_U range from 2.2×10^{-8} to 10^{-6} .NODE=M004R01
NODE=M004R01

NODE=M004R01;LINKAGE=A

 $\Gamma(\text{invisible})/\Gamma(K^+K^-)$ Γ_{31}/Γ_1

VALUE CL%

DOCUMENT ID TECN COMMENT

<3.4 × 10 ⁻⁴	90	ABLIKIM	18S	BES3	$J/\psi \rightarrow \phi\eta \rightarrow \phi\pi^+\pi^-\pi^0$

NODE=M004R02
NODE=M004R02

————— Lepton Family number (LF) violating modes —————

NODE=M00422A

 $\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE CL%

DOCUMENT ID TECN COMMENT

<2 × 10 ⁻⁶	90	ACHASOV	10A	SND	$e^+e^- \rightarrow e^\pm\mu^\mp$

NODE=M004R29
NODE=M004R29 $\pi^+\pi^-\pi^0 / \rho\pi$ AMPLITUDE RATIO a_1 IN DECAY OF $\phi \rightarrow \pi^+\pi^-\pi^0$

NODE=M004D1

NIECKNIG 12 describes final-state interactions between the three pions in a dispersive framework using data on the $\pi\pi$ P -wave scattering phase shift.

NODE=M004D1

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.2 OUR AVERAGE					
10.1±4.4±1.7	80k		¹ AKHMETSHIN 06	CMD2	1.017–1.021 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0±1.1±0.6	1.98M		^{2,3} ALOISIO 03	KLOE	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
–6 < a_1 < 6	500k		³ ACHASOV 02	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
–16 < a_1 < 11	90	9.8k	^{1,4} AKHMETSHIN 98	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma\gamma$
¹ Dalitz plot analysis taking into account interference between the contact and $\rho\pi$ amplitudes.					
² From a fit without limitations on charged and neutral ρ masses and widths.					
³ Recalculated by us to match the notations of AKHMETSHIN 98.					
⁴ Assuming zero phase for the contact term.					

NODE=M004D1

NODE=M004D1;LINKAGE=AK

NODE=M004D;LINKAGE=L1

NODE=M004D;LINKAGE=L3

NODE=M004D1;LINKAGE=KL

PARAMETER β IN $\phi \rightarrow P e^+ e^-$ DECAYS

In the one-pole approximation the electromagnetic transition form factor for $\phi \rightarrow P e^+ e^-$ ($P = \pi, \eta$) is given as a function of the $e^+ e^-$ invariant mass squared, q^2 , by the expression:

$$|F(q^2)|^2 = (1 - q^2/\Lambda^2)^{-2},$$

where vector meson dominance predicts parameter $\Lambda \approx 0.770$ GeV ($\Lambda^{-2} \approx 1.687$ GeV $^{-2}$). The slope of this form factor, $\beta = dF/dq^2(q^2=0)$, equals Λ^{-2} in this approximation.

The measurements below obtain β in the one-pole approximation.

NODE=M004230

NODE=M004230

PARAMETER β IN $\phi \rightarrow \pi^0 e^+ e^-$ DECAY

VALUE (GeV $^{-2}$)	EVTS	DOCUMENT ID	TECN	COMMENT
2.02±0.11	9.5k	¹ ANASTASI 16B	KLOE	1.02 $e^+e^- \rightarrow \pi^0 e^+e^-$
¹ The error combines statistical and systematic uncertainties.				

NODE=M004A00
NODE=M004A00

NODE=M004A00;LINKAGE=A

PARAMETER β IN $\phi \rightarrow \eta e^+ e^-$ DECAY

VALUE (GeV $^{-2}$)	EVTS	DOCUMENT ID	TECN	COMMENT
1.29±0.13 OUR AVERAGE				
1.28±0.10 $^{+0.09}_{-0.08}$	30k	BABUSCI 15	KLOE	1.02 $e^+e^- \rightarrow \eta e^+e^-$
3.8 ±1.8	213	¹ ACHASOV 01B	SND	1.02 $e^+e^- \rightarrow \eta e^+e^-$
¹ The uncertainty is statistical only. The systematic one is negligible, in comparison.				

NODE=M004BFP
NODE=M004BFP

NODE=M004BFP;LINKAGE=A

$\phi(1020)$ REFERENCES

LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
HOID	20	EPJ C80 988	B.-L. Hoid, M. Hoferichter, B. Kubis	(BONN, BERN)
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)
HOERICHT...	19	JHEP 1908 137	M. Hoferichter, B.-L. Hoid, B. Kubis	(WASH, BONN)
ABLIKIM	18S	PR D98 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>	
KOZYREV	18	PL B779 64	E.A. Kozyrev <i>et al.</i>	(CMD-3 Collab.)
AKHMETSHIN	17	PL B768 345	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
ACHASOV	16A	PR D93 092001	M.N. Achasov <i>et al.</i>	(SND Collab.)
ANASTASI	16B	PL B757 362	A. Anastasi <i>et al.</i>	(KLOE-2 Collab.)
KOZYREV	16	PL B760 314	E.A. Kozyrev <i>et al.</i>	(CMD-3 Collab.)
BABUSCI	15	PL B742 1	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)
PDG	15	RPP 2015 at pdg.lbl.gov		(PDG Collab.)
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
BABUSCI	13B	PL B720 111	D. Babusci <i>et al.</i>	(KLOE-2 Collab.)
BENAYOUN	13	EPJ C73 2453	M. Benayoun, P. David, L. DelBuono	(PARIN, BERLIN+)
LEES	13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ARCHILLI	12	PL B706 251	F. Archilli <i>et al.</i>	(KLOE-2 Collab.)
BENAYOUN	12	EPJ C72 1848	M. Benayoun <i>et al.</i>	
NIECKNIG	12	EPJ C72 2014	F. Niecknig, B. Kubis, S.P. Schneider	(BONN)
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)
AKHMETSHIN	11	PL B695 412	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
ACHASOV	10A	PR D81 057102	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BENAYOUN	10	EPJ C65 211	M. Benayoun <i>et al.</i>	
AMBROSINO	09C	PL B679 10	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AKHMETSHIN	08	PL B669 217	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)
AMBROSINO	08G	PL B669 223	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
AULCHENKO	08	JETPL 88 85	V. Aulchenko <i>et al.</i>	(CMD-2 Collab.)

Translated from ZETFP 88 93.

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FLOREZ-BAEZ	08	PR D78 077301	F.V. Florez-Baez, G. Lopez Castro		REFID=52584
ACHASOV	07B	PR D76 077101	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51942
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AMBROSINO	07A	PL B648 267	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51646
DUBYNISKIY	07	PR D75 113001	S. Dubynskiy <i>et al.</i>		REFID=51719
ACHASOV	06A	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
AKHMETSHIN	06	PL B642 203	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=51465
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AMBROSINO	05	PL B608 199	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=50453
AUBERT,B	05J	PR D72 052008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50824
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
ALOISIO	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
AULCHENKO	03B	JETP 97 24	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49613
		Translated from ZETF 124 28.			
ACHASOV	02	PR D65 032002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48549
ACHASOV	02D	JETPL 75 449	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48814
		Translated from ZETFP 75 539.			
ALOISIO	02C	PL B536 209	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48823
ALOISIO	02D	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ALOISIO	02E	PL B541 45	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48825
FISCHBACH	02	PL B526 355	E. Fischbach, A.W. Overhauser, B. Woodahl		REFID=48575
GOKALP	02	JP G28 2783	A. Gokalp <i>et al.</i>		REFID=49167
ACHASOV	01B	PL B504 275	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48111
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
ACHASOV	01G	PRL 86 1698	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48315
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
AKHMETSHIN	01	PL B501 191	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48110
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
AKHMETSHIN	01C	PL B503 237	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48323
BENAYOUN	01	EPJ C22 503	M. Benayoun, H.B. O'Connell		REFID=48570
ACHASOV	00	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
ACHASOV	00B	JETP 90 17	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47425
		Translated from ZETF 117 22.			
ACHASOV	00C	PL B474 188	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47431
ACHASOV	00D	JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
		Translated from ZETFP 72 411.			
ACHASOV	00E	NP B569 158	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47927
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
AKHMETSHIN	00B	PL B473 337	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47422
AKHMETSHIN	00E	PL B491 81	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47936
AKHMETSHIN	00F	PL B494 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47937
AULCHENKO	00A	JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
		Translated from ZETF 117 1067.			
BRAMON	00	PL B486 406	A. Bramon <i>et al.</i>		REFID=47969
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ACHASOV	99	PL B449 122	M.N. Achasov <i>et al.</i>		REFID=46896
ACHASOV	99C	PL B456 304	M.N. Achasov <i>et al.</i>		REFID=46939
AKHMETSHIN	99B	PL B462 371	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47392
AKHMETSHIN	99C	PL B462 380	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47393
AKHMETSHIN	99D	PL B466 385	R.R. Akhmetshin <i>et al.</i>		REFID=47397
Also		PL B508 217 (errat.)	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48328
AKHMETSHIN	99F	PL B460 242	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47473
AULCHENKO	99	JETPL 69 97	V.M. Aulchenko <i>et al.</i>		REFID=46920
		Translated from ZETFP 69 87.			
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
ACHASOV	98F	JETPL 68 573	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46321
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
AKHMETSHIN	98	PL B434 426	R.R. Akhmetshin <i>et al.</i>	(CMD-2 Collab.)	REFID=46325
AULCHENKO	98	PL B436 199	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46336
BARBERIS	98	PL B432 436	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46344
AKHMETSHIN	97B	PL B415 445	R.R. Akhmetshin <i>et al.</i>	(NOVO, BOST, PITT+)	REFID=45801
AKHMETSHIN	97C	PL B415 452	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=45802
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
AKHMETSHIN	95	PL B364 199	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=44617
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
BARKOV	88	SJNP 47 248	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=41024
		Translated from YAF 47 393.			
DOLINSKY	88	SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
		Translated from YAF 48 442.			
DRUZHININ	87	ZPHY C37 1	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=40448
ARMSTRONG	86	PL 166B 245	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=20563
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
BEBEK	86	PRL 56 1893	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=11540
DAVENPORT	86	PR D33 2519	T.F. Davenport (TUFTS, ARIZ, FNAL, FSU, NDAM+)		REFID=20567
DIJKSTRA	86	ZPHY C31 375	H. Dijkstra <i>et al.</i>	(ANIK, BRIS, CERN+)	REFID=20568
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)	REFID=20569
GOLUBEV	86	SJNP 44 409	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40449
		Translated from YAF 44 633.			
ALBRECHT	85D	PL 153B 343	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=20562
GOLUBEV	85	SJNP 41 756	V.B. Golubev <i>et al.</i>	(NOVO)	REFID=40450
		Translated from YAF 41 1183.			
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BARATE	83	PL 121B 449	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, IND)	REFID=12177
KURDADZE	83C	JETPL 38 366	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20560
		Translated from ZETFP 38 306.			
ARENTON	82	PR D25 2241	M.W. Arenton <i>et al.</i>	(ANL, ILL)	REFID=20556
PELLINEN	82	PS 25 599	A. Pellinen, M. Roos	(HELs)	REFID=20557
DAUM	81	PL 100B 439	C. Daum <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)	REFID=20552
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)	REFID=20553
Also		Private Comm.	S.I. Eidelman	(NOVO)	REFID=20554
VASSERMAN	81	PL 99B 62	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=20555
Also		SJNP 35 240	L.M. Kurdadze <i>et al.</i>		REFID=47475
		Translated from YAF 35 352.			

CORDIER	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
CORDIER	79	PL 81B 389	A. Cordier <i>et al.</i>	(LALO)	REFID=20549
BUKIN	78B	SJNP 27 521	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20545
BUKIN	78C	Translated from YAF 27 985	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20544
COOPER	78B	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
LOSTY	78	NP B133 38	M.J. Losty <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=20547
AKERLOF	77	PRL 39 861	C.W. Akerlof <i>et al.</i>	(FNAL, MICH, PURD)	REFID=20534
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
BALDI	77	PL 68B 381	R. Baldi <i>et al.</i>	(GEVA)	REFID=20536
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+)	REFID=20537
COHEN	77	PRL 38 269	D. Cohen <i>et al.</i>	(ANL)	REFID=20538
LAVEN	77	NP B127 43	H. Laven <i>et al.</i>	(AACH3, BERL, CERN, LOIC+)	REFID=20541
LYONS	77	NP B125 207	L. Lyons, A.M. Cooper, A.G. Clark	(OXF)	REFID=20232
COSME	76	PL 63B 352	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20529
KALBFLEISCH	76	PR D13 22	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20531
PARROUR	76	PL 63B 357	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20532
PARROUR	76B	PL 63B 362	G. Parrou <i>et al.</i>	(ORSAY)	REFID=20533
KALBFLEISCH	75	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
AYRES	74	PRL 32 1463	D.S. Ayres <i>et al.</i>	(ANL)	REFID=20522
BESCH	74	NP B70 257	H.J. Besch <i>et al.</i>	(BONN)	REFID=20523
COSME	74	PL 48B 155	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20525
COSME	74B	PL 48B 159	G. Cosme <i>et al.</i>	(ORSAY)	REFID=20526
DEGROOT	74	NP B74 77	A.J. de Groot <i>et al.</i>	(AMST, NIJM)	REFID=20527
AUGUSTIN	73	PRL 30 462	J.E. Augustin <i>et al.</i>	(ORSAY)	REFID=47515
BALLAM	73	PR D7 3150	J. Ballam <i>et al.</i>	(SLAC, LBL)	REFID=20520
BINNIE	73B	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
ALVENSLEB...	72	PRL 28 66	H. Alvensleben <i>et al.</i>	(MIT, DESY)	REFID=20514
BORENSTEIN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
COLLEY	72	NP B50 1	D.C. Colley <i>et al.</i>	(BIRM, GLAS)	REFID=20519
BALAKIN	71	PL 34B 328	V.E. Balakin <i>et al.</i>	(NOVO)	REFID=20507
CHATELUS	71	Thesis LAL 1247	Y. Chatelus	(STRB)	REFID=20508
Also		PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
HAYES	71	PR D4 899	S. Hayes <i>et al.</i>	(CORN)	REFID=20511
STOTTLE...	71	Thesis ORO 2504 170	A.R. Stottlemyer	(UMD)	REFID=20512
BIZOT	70	PL 32B 416	J.C. Bizot <i>et al.</i>	(ORSAY)	REFID=20501
Also		Liverpool Sym. 69	J.P. Perez-y-Jorba		REFID=20502
EARLES	70	PRL 25 1312	D.R. Earles <i>et al.</i>	(NEAS)	REFID=20504
LINDSEY	66	PR 147 913	J.S. Lindsey, G. Smith	(LRL)	REFID=20481
LONDON	66	PR 143 1034	G.W. London <i>et al.</i>	(BNL, SYRA) IGJPC	REFID=11774
BADIER	65B	PL 17 337	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)	REFID=20253
LINDSEY	65	PRL 15 221	J.S. Lindsey, G.A. Smith	(LRL)	REFID=20478
LINDSEY 65 data included in LINDSEY 66.					
SCHLEIN	63	PRL 10 368	P.E. Schlein <i>et al.</i>	(UCLA) IGJP	REFID=20474

$h_1(1170)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

$h_1(1170)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1166 ± 5 ± 3	¹ ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1168 ± 4	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1190 ± 60	² DANKOWY...	81	SPEC	$8 \pi p \rightarrow 3 \pi n$

¹ Average and spread of values using 2 variants of the model of BOWLER 75.

² Uses the model of BOWLER 75.

$h_1(1170)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
375 ± 6 ± 34	³ ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
345 ± 6	ANDO	92	SPEC	$8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
320 ± 50	⁴ DANKOWY...	81	SPEC	$8 \pi p \rightarrow 3 \pi n$

³ Average and spread of values using 2 variants of the model of BOWLER 75.

⁴ Uses the model of BOWLER 75.

$h_1(1170)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho \pi$	seen

REFID=20240
REFID=20549
REFID=20545
REFID=20544
REFID=20235
REFID=20547
REFID=20534
REFID=20120
REFID=20536
REFID=20537
REFID=20538
REFID=20541
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REFID=20223
REFID=20522
REFID=20523
REFID=20525
REFID=20526
REFID=20527
REFID=47515
REFID=20520
REFID=20216
REFID=20205
REFID=20514
REFID=20215
REFID=20519
REFID=20507
REFID=20508
REFID=20501
REFID=20511
REFID=20512
REFID=20501
REFID=20502
REFID=20504
REFID=20481
REFID=11774
REFID=20253
REFID=20478
REFID=20474

NODE=M030

NODE=M030M

NODE=M030M

OCCUR=2

NODE=M030M;LINKAGE=B

NODE=M030M;LINKAGE=C

NODE=M030W

NODE=M030W

OCCUR=2

NODE=M030W;LINKAGE=B

NODE=M030W;LINKAGE=C

NODE=M030215;NODE=M030

DESIG=1;OUR EST;→ UNCHECKED ←

$h_1(1170)$ BRANCHING RATIOS

NODE=M030220

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	ANDO	92	SPEC $8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
seen	ATKINSON	84	OMEG $20-70 \gamma p \rightarrow \pi^+ \pi^- \pi^0 p$
seen	DANKOWY...	81	SPEC $8 \pi p \rightarrow 3 \pi n$

NODE=M030R1
NODE=M030R1 **$h_1(1170)$ REFERENCES**

ANDO	92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
ATKINSON	84	NP B231 15	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
DANKOWY...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNT0, BNL, CARL+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M030

REFID=43171
REFID=20574
REFID=20572
REFID=20571 **$b_1(1235)$**

$$J^G(J^{PC}) = 1^+(1^{+-})$$

NODE=M011

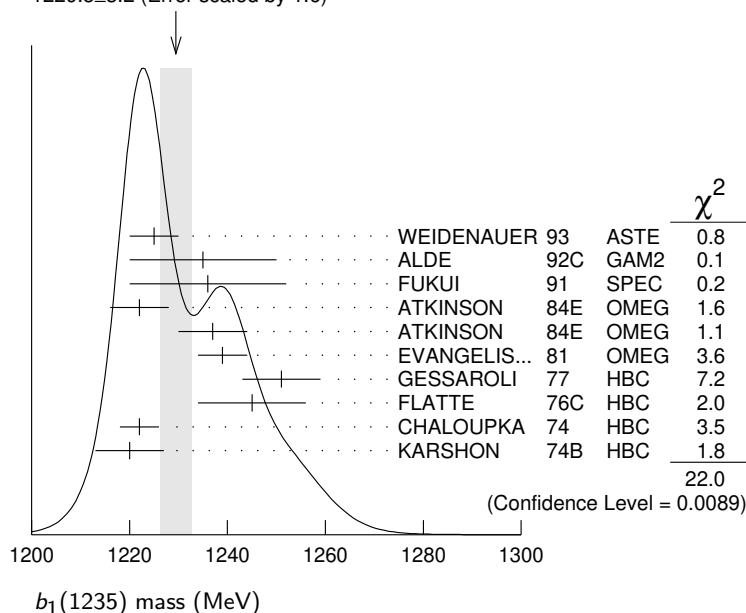
 $b_1(1235)$ MASS

NODE=M011M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1229.5 ± 3.2 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.					
1225 ± 5		WEIDENAUER 93	ASTE		$\bar{p} p \rightarrow 2\pi^+ 2\pi^- \pi^0$
1235 ± 15		ALDE	92C	GAM2	$38,100 \pi^- p \rightarrow \omega \pi^0 n$
1236 ± 16		FUKUI	91	SPEC	$8.95 \pi^- p \rightarrow \omega \pi^0 n$
1222 ± 6		ATKINSON	84E	OMEG ±	$25-55 \gamma p \rightarrow \omega \pi X$
1237 ± 7		ATKINSON	84E	OMEG 0	$25-55 \gamma p \rightarrow \omega \pi X$
1239 ± 5		EVANGELIS...	81	OMEG -	$12 \pi^- p \rightarrow \omega \pi p$
1251 ± 8	450	GESSAROLI	77	HBC -	$11 \pi^- p \rightarrow \pi^- \omega p$
1245 ± 11	890	FLATTE	76C	HBC -	$4.2 K^- p \rightarrow \pi^- \omega \Sigma^+$
1222 ± 4	1400	CHALOUPKA	74	HBC -	$3.9 \pi^- p$
1220 ± 7	600	KARSHON	74B	HBC +	$4.9 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1190 ± 10		AUGUSTIN	89	DM2 ±	$e^+ e^- \rightarrow 5\pi$
1213 ± 5		ATKINSON	84C	OMEG 0	$20-70 \gamma p$
1271 ± 11		COLLICK	84	SPEC +	$200 \pi^+ Z \rightarrow Z \pi \omega$

NODE=M011M

OCCUR=2

WEIGHTED AVERAGE
1229.5±3.2 (Error scaled by 1.6) **$b_1(1235)$ WIDTH**

NODE=M011W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
142 ± 9 OUR AVERAGE		Error includes scale factor of 1.2.			
113 ± 12		WEIDENAUER 93	ASTE		$\bar{p}p \rightarrow 2\pi^+ 2\pi^- \pi^0$
160 ± 30		ALDE	92C	GAM2	$38,100 \pi^- p \rightarrow \omega \pi^0 n$
151 ± 31		FUKUI	91	SPEC	$8.95 \pi^- p \rightarrow \omega \pi^0 n$
170 ± 15		EVANGELIS...	81	OMEG	$12 \pi^- p \rightarrow \omega \pi p$
170 ± 50	225	BALTAY	78B	HBC	$15 \pi^+ p \rightarrow p 4\pi$
155 ± 32	450	GESSAROLI	77	HBC	$11 \pi^- p \rightarrow \pi^- \omega p$
182 ± 45	890	FLATTE	76C	HBC	$4.2 K^- p \rightarrow \pi^- \omega \Sigma^+$
135 ± 20	1400	CHALOUPKA	74	HBC	$3.9 \pi^- p$
156 ± 22	600	KARSHON	74B	HBC	$4.9 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
210 ± 19		AUGUSTIN	89	DM2	$e^+ e^- \rightarrow 5\pi$
231 ± 14		ATKINSON	84C	OMEG	$20-70 \gamma p$
232 ± 29		COLLICK	84	SPEC	$200 \pi^+ Z \rightarrow Z \pi \omega$

NODE=M011W

 $b_1(1235)$ DECAY MODES

NODE=M011215;NODE=M011

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\omega \pi$ [D/S amplitude ratio = 0.277 ± 0.027]	seen	
Γ_2 $\pi^\pm \gamma$	$(1.6 \pm 0.4) \times 10^{-3}$	
Γ_3 $\eta \rho$	seen	
Γ_4 $\pi^+ \pi^+ \pi^- \pi^0$	< 50 %	84%
Γ_5 $K^*(892)^\pm K^\mp$	seen	
Γ_6 $(KK)^\pm \pi^0$	< 8 %	90%
Γ_7 $K_S^0 K_L^0 \pi^\pm$	< 6 %	90%
Γ_8 $K_S^0 K_S^0 \pi^\pm$	< 2 %	90%
Γ_9 $\phi \pi$	< 1.5 %	84%

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=74

DESIG=71;OUR EST;→ UNCHECKED ←

DESIG=73;OUR EST;→ UNCHECKED ←

DESIG=72;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

 $b_1(1235)$ PARTIAL WIDTHS

NODE=M011220

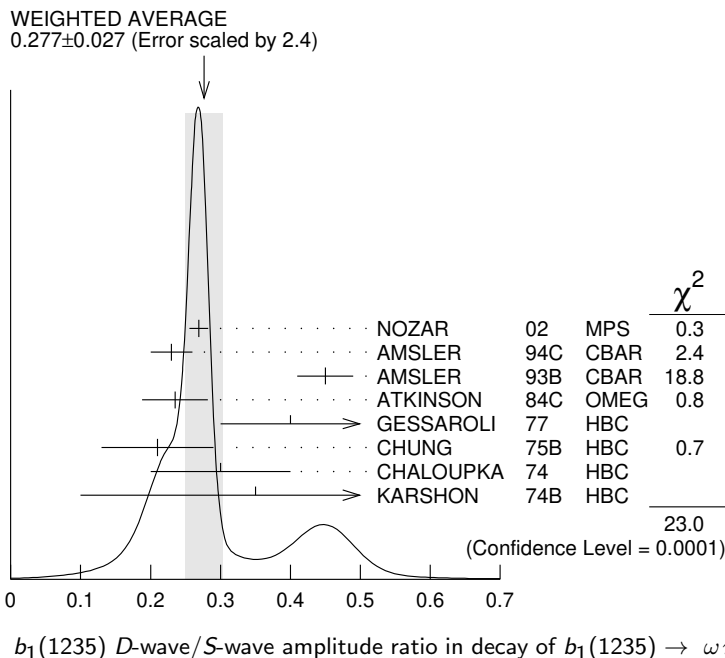
$\Gamma(\pi^\pm \gamma)$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2
VALUE (keV)					
230 ± 60	COLLICK	84	SPEC	$200 \pi^+ Z \rightarrow Z \pi \omega$	

NODE=M011W3
NODE=M011W3 **$b_1(1235)$ D-wave/S-wave AMPLITUDE RATIO
IN DECAY OF $b_1(1235) \rightarrow \omega \pi$**

NODE=M011DS

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.277 ± 0.027 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.			
0.269 ± 0.009 ± 0.010		NOZAR	02	MPS	$18 \pi^- p \rightarrow \omega \pi^- p$
0.23 ± 0.03		AMSLER	94C	CBAR	$0.0 \bar{p} p \rightarrow \omega \eta \pi^0$
0.45 ± 0.04		AMSLER	93B	CBAR	$0.0 \bar{p} p \rightarrow \omega \pi^0 \pi^0$
0.235 ± 0.047		ATKINSON	84C	OMEG	$20-70 \gamma p$
0.4 $^{+0.1}_{-0.1}$		GESSAROLI	77	HBC	$11 \pi^- p \rightarrow \pi^- \omega p$
0.21 ± 0.08		CHUNG	75B	HBC	$7.1 \pi^+ p$
0.3 ± 0.1		CHALOUPKA	74	HBC	$3.9-7.5 \pi^- p$
0.35 ± 0.25	600	KARSHON	74B	HBC	$4.9 \pi^+ p$

NODE=M011DS



$b_1(1235)$ D-wave/S-wave AMPLITUDE PHASE DIFFERENCE IN DECAY OF $b_1(1235) \rightarrow \omega \pi$

NODE=M011PH

VALUE (°)	DOCUMENT ID	TECN	CHG	COMMENT
10.5±2.4±3.9	NOZAR	02	MPS	— 18 $\pi^- p \rightarrow \omega \pi^- p$

NODE=M011PH

$b_1(1235)$ BRANCHING RATIOS

NODE=M011230

$\Gamma(\eta\rho)/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_3/Γ_1
<0.10	ATKINSON	84D	OMEG	20–70 γp	

NODE=M011R9
NODE=M011R9

$\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_4/Γ_1
<0.5	ABOLINS	63	HBC	+ 3.5 $\pi^+ p$	

NODE=M011R1
NODE=M011R1

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_5/Γ
seen	¹ ABLIKIM	10E	BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$	

NODE=M011R10
NODE=M011R10

¹ From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M011R10;LINKAGE=AB

$\Gamma((K\bar{K})^\pm \pi^0)/\Gamma(\omega\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_6/Γ_1
<0.08	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$	

NODE=M011R6
NODE=M011R6

$\Gamma(K_S^0 K_L^0 \pi^\pm)/\Gamma(\omega\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_7/Γ_1
<0.06	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$	

NODE=M011R8
NODE=M011R8

$\Gamma(K_S^0 K_S^0 \pi^\pm)/\Gamma(\omega\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_8/Γ_1
<0.02	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$	

NODE=M011R7
NODE=M011R7

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_9/Γ_1
<0.004	95	VIKTOROV	96	SPEC	0 32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$	

NODE=M011R4
NODE=M011R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04	95	BIZZARRI	69	HBC	± 0.0 $\bar{p} p$
<0.015		DAHL	67	HBC	1.6–4.2 $\pi^- p$

$b_1(1235)$ REFERENCES

ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
NOZAR	02	PL B541 35	M. Nozar <i>et al.</i>		REFID=48850
VIKTOROV	96	PAN 59 1184	V.A. Viktorov <i>et al.</i>	(SERP)	REFID=45203
		Translated from YAF 59 1239.			
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41859
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
ATKINSON	84C	NP B243 1	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20625
ATKINSON	84D	NP B242 269	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20623
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20624
COLLICK	84	PRL 53 2374	B. Collick <i>et al.</i>	(MINN, ROCH, FNAL)	REFID=20626
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
FLATTE	76C	PL 64B 225	S.M. Flatte <i>et al.</i>	(CERN, AMST, NIJ+)	REFID=20615
CHUNG	75B	PR D11 2426	S.U. Chung <i>et al.</i>	(BNL, LBL, UCSC)	REFID=20613
CHALOUPKA	74	PL 51B 407	V. Chaloupka <i>et al.</i>	(CERN)	REFID=20611
KARSHON	74B	PR D10 3608	U. Karshon <i>et al.</i>	(REHO)	REFID=20612
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)	REFID=20171
BALTAY	67	PRL 18 93	C. Baltay <i>et al.</i>	(COLU)	REFID=20159
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL)	REFID=20321
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006

NODE=M010

 $a_1(1260)$

$$I^G(J^{PC}) = 1^-(1^{++})$$

See also our review under the $a_1(1260)$ in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M010

 $a_1(1260)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M010PP

NODE=M010PP

NODE=M010PP

NEW;→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$(1209^{+13}_{-10}) - i(288^{+45}_{-12})$ OUR ESTIMATE			
$[(1209 \pm 4^{+12}_{-9}) - i(288 \pm 6^{+45}_{-10})]$ MeV OUR 2023 ESTIMATE]			
$(1209 \pm 4^{+12}_{-9}) - i(288 \pm 6^{+45}_{-10})$	MIKHASENKO 18	RVUE	$\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau$

 $a_1(1260)$ MASS

NODE=M010M

NODE=M010M

→ UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1230 ± 40 OUR ESTIMATE				
1299 $^{+12}_{-28}$	46M	¹ AGHASYAN	18B	COMP $190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1195.05 \pm 1.05 \pm 6.33$	894k	AAIJ	18AI	LHCB $D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
$1225 \pm 9 \pm 20$	7k	² DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
$1255 \pm 6 \pm 7$	420k	³ ALEKSEEV	10	COMP $190 \pi^- Pb \rightarrow \pi^- \pi^+ \pi^+ Pb'$
$1243 \pm 12 \pm 20$		⁴ AUBERT	07AU	BABR $10.6 e^+ e^- \rightarrow \rho^0 \rho^\pm \pi^\mp \gamma$
1230–1270	6360	⁵ LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1203 ± 3		⁶ GOMEZ-DUM.	.04	RVUE $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
1330 ± 24	90k	SALVINI	04	OBLX $\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
$1331 \pm 10 \pm 3$	37k	⁷ ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
$1255 \pm 7 \pm 6$	5904	⁸ ABREU	98G	DLPH $e^+ e^-$
$1207 \pm 5 \pm 8$	5904	⁹ ABREU	98G	DLPH $e^+ e^-$
$1196 \pm 4 \pm 5$	5904	^{10,11} ABREU	98G	DLPH $e^+ e^-$
1240 ± 10		BARBERIS	98B	$450 p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
$1262 \pm 9 \pm 7$		^{8,12} ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
$1210 \pm 7 \pm 2$		^{9,12} ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
$1211 \pm 7 \pm 50$		⁹ ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1121 ± 8		¹³ ANDO	92	SPEC $8 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1242 ± 37		¹⁴ IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$

OCCUR=2

OCCUR=3

OCCUR=2

1260	±14	15	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=2
1250	± 9	16	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=3
1208	±15		ARMSTRONG	90	OMEG	$300.0 p p \rightarrow$ $p p \pi^+ \pi^- \pi^0$	
1220	±15	17	ISGUR	89	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
1260	±25	18	BOWLER	88	RVUE		
1166	±18 ±11		BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
1164	±41 ±23		BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$	OCCUR=2
1250	±40	17	TORNQVIST	87	RVUE		
1046	±11		ALBRECHT	86B	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
1056	±20 ±15		RUCKSTUHL	86	DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
1194	±14 ±10		SCHMIDKE	86	MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
1255	±23		BELLINI	85	SPEC	$40 \pi^- A \rightarrow$ $\pi^- \pi^+ \pi^- A$	
1240	±80	19	DANKOWY...	81	SPEC	$8.45 \pi^- p \rightarrow n 3\pi$	
1280	±30	19	DAUM	81B	CNTR	$63.94 \pi^- p \rightarrow p 3\pi$	
1041	±13	20	GAVILLET	77	HBC	$4.2 K^- p \rightarrow \Sigma 3\pi$	

¹ Statistical error negligible.

² Reanalysis of CLEO data using Breit-Wigner parameterization.

³ Superseded by AGHASYAN 2018B.

⁴ The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.

⁵ Using the Breit-Wigner parameterization; strong correlation between mass and width.

⁶ Using the data of BARATE 98R.

⁷ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.

⁸ Uses the model of KUHN 90.

⁹ Uses the model of ISGUR 89.

¹⁰ Includes the effect of a possible a_1' state.

¹¹ Uses the model of FEINDT 90.

¹² Supersedes AKERS 95P.

¹³ Average and spread of values using 2 variants of the model of BOWLER 75.

¹⁴ Reanalysis of RUCKSTUHL 86.

¹⁵ Reanalysis of SCHMIDKE 86.

¹⁶ Reanalysis of ALBRECHT 86B.

¹⁷ From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.

¹⁸ From a combined reanalysis of ALBRECHT 86B and DAUM 81B.

¹⁹ Uses the model of BOWLER 75.

²⁰ Produced in K^- backward scattering.

NODE=M010M;LINKAGE=Q
 NODE=M010M;LINKAGE=V
 NODE=M010M;LINKAGE=R
 NODE=M010M;LINKAGE=AU
 NODE=M010M;LINKAGE=LI
 NODE=M010M;LINKAGE=GO
 NODE=M010M;LINKAGE=B6
 NODE=M010M;LINKAGE=KS
 NODE=M010M;LINKAGE=IM
 NODE=M010M;LINKAGE=A1
 NODE=M010M;LINKAGE=F1
 NODE=M010M;LINKAGE=X
 NODE=M010M;LINKAGE=P
 NODE=M010M;LINKAGE=I
 NODE=M010M;LINKAGE=L
 NODE=M010M;LINKAGE=M
 NODE=M010M;LINKAGE=K
 NODE=M010M;LINKAGE=G
 NODE=M010M;LINKAGE=D
 NODE=M010M;LINKAGE=F

$a_1(1260)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
380 ± 80 OUR AVERAGE		[420 ± 35 MeV OUR 2023 AVERAGE]		
380 ± 80	46M	¹ AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow$ $\pi^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
422.01 ± 2.10 ± 12.72	894k	AAIJ	18A	LHCB $D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
430 ± 24 ± 31		² DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
367 ± 9 ± 28 ± 25	420k	³ ALEKSEEV	10	COMP 190 $\pi^- P b \rightarrow$ $\pi^- \pi^- \pi^+ P b'$
410 ± 31 ± 30		⁴ AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow$ $\rho^0 \rho^\pm \pi^\mp \gamma$
520–680	6360	⁵ LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
480 ± 20		⁶ GOMEZ-DUM..04	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu_\tau$
580 ± 41	90k	SALVINI	04	OBLX $\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
460 ± 85	205	⁷ DRUTSKOY	02	BELL $B \rightarrow D(*) K^* 0$
814 ± 36 ± 13	37k	⁸ ASNER	00	CLE2 10.6 $e^+ e^- \rightarrow$ $\tau^+ \tau^-, \tau^- \rightarrow$ $\pi^- \pi^0 \pi^0 \nu_\tau$
450 ± 50	22k	⁹ AKHMETSHIN 99E	CMD2	1.05–1.38 $e^+ e^- \rightarrow$ $\pi^+ \pi^- \pi^0 \pi^0$
570 ± 10		¹⁰ BONDAR	99	RVUE $e^+ e^- \rightarrow 4\pi, \tau \rightarrow$ $3\pi \nu_\tau$
587 ± 27 ± 21	5904	¹¹ ABREU	98G	DLPH $e^+ e^-$
478 ± 3 ± 15	5904	¹² ABREU	98G	DLPH $e^+ e^-$

NODE=M010W

NODE=M010W
 → UNCHECKED ←
 NEW

OCCUR=2

425	± 14	± 8	5904	13,14	ABREU	98G	DLPH	e^+e^-	OCCUR=3
400	± 35				BARBERIS	98B		450 $pp \rightarrow$ $p_f \pi^+ \pi^- \pi^0 p_s$	
621	± 32	± 58		11,15	ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow$ $3\pi\nu$	
457	± 15	± 17		12,15	ACKERSTAFF	97R	OPAL	$E_{cm}^{ee} = 88-94, \tau \rightarrow$ $3\pi\nu$	OCCUR=2
446	± 21	$+140$ -0		12	ALBRECHT	93C	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
239	± 11				ANDO	92	SPEC	$8 \pi^- p \rightarrow$ $\pi^+ \pi^- \pi^0 n$	
266	± 13	± 4		16	ANDO	92	SPEC	$8 \pi^- p \rightarrow$ $\pi^+ \pi^- \pi^0 n$	OCCUR=3
465	$+228$ -143			17	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	
298	$+40$ -34			18	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=2
488	± 32			19	IVANOV	91	RVUE	$\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$	OCCUR=3
430	± 50				ARMSTRONG	90	OMEG	300.0 $pp \rightarrow$ $pp \pi^+ \pi^- \pi^0$	
420	± 40			20	ISGUR	89	RVUE	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
396	± 43			21	BOWLER	88	RVUE		
405	± 75	± 25			BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
419	± 108	± 57			BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$	OCCUR=2
521	± 27				ALBRECHT	86B	ARG	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
476	$+132$ -120	± 54			RUCKSTUHL	86	DLCO	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
462	± 56	± 30			SCHMIDKE	86	MRK2	$\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$	
292	± 40				BELLINI	85	SPEC	$40 \pi^- A \rightarrow$ $\pi^- \pi^+ \pi^- A$	
380	± 100			22	DANKOWY...	81	SPEC	$8.45 \pi^- p \rightarrow n 3\pi$	
300	± 50			22	DAUM	81B	CNTR	$63,94 \pi^- p \rightarrow p 3\pi$	
230	± 50			23	GAVILLET	77	HBC	$4.2 K^- p \rightarrow \Sigma 3\pi$	

¹ Statistical error negligible.

² Reanalysis of CLEO data using Breit-Wigner parameterization.

³ Superseded by AGHASYAN 2018B.

⁴ The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.

⁵ Using the Breit-Wigner parameterization; strong correlation between mass and width.

⁶ Using the data of BARATE 98R.

⁷ From a fit of the $K^- K^{*0}$ distribution assuming $m_{a_1} = 1230$ MeV and purely resonant production of the $K^- K^{*0}$ system.

⁸ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.

⁹ Using the $a_1(1260)$ mass of 1230 MeV.

¹⁰ From AKHMETSHIN 99E and ASNER 00 data using the $a_1(1260)$ mass of 1230 MeV.

¹¹ Uses the model of KUHN 90.

¹² Uses the model of ISGUR 89.

¹³ Includes the effect of a possible a_1' state.

¹⁴ Uses the model of FEINDT 90.

¹⁵ Supersedes AKERS 95P.

¹⁶ Average and spread of values using 2 variants of the model of BOWLER 75.

¹⁷ Reanalysis of RUCKSTUHL 86.

¹⁸ Reanalysis of SCHMIDKE 86.

¹⁹ Reanalysis of ALBRECHT 86B.

²⁰ From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.

²¹ From a combined reanalysis of ALBRECHT 86B and DAUM 81B.

²² Uses the model of BOWLER 75.

²³ Produced in K^- backward scattering.

NODE=M010W;LINKAGE=Q
NODE=M010W;LINKAGE=V
NODE=M010W;LINKAGE=R
NODE=M010W;LINKAGE=AU
NODE=M010W;LINKAGE=LI
NODE=M010W;LINKAGE=GO
NODE=M010W;LINKAGE=DR

NODE=M010W;LINKAGE=B6
NODE=M010W;LINKAGE=WE
NODE=M010W;LINKAGE=WB
NODE=M010W;LINKAGE=KS
NODE=M010W;LINKAGE=IM
NODE=M010W;LINKAGE=A1
NODE=M010W;LINKAGE=F1
NODE=M010W;LINKAGE=X
NODE=M010W;LINKAGE=P
NODE=M010W;LINKAGE=I
NODE=M010W;LINKAGE=L
NODE=M010W;LINKAGE=M
NODE=M010W;LINKAGE=K
NODE=M010W;LINKAGE=G
NODE=M010W;LINKAGE=D
NODE=M010W;LINKAGE=F

$a_1(1260)$ DECAY MODES

NODE=M010215;NODE=M010

Mode	Fraction (Γ_i/Γ)
Γ_1 3π	seen
Γ_2 $(\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen
Γ_3 $(\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen
Γ_4 $(\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen
Γ_5 $(\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen
Γ_6 $f_0(500)\pi, f_0 \rightarrow \pi\pi$	seen
Γ_7 $f_0(980)\pi, f_0 \rightarrow \pi\pi$	seen

DESIG=17;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=9;OUR EST;→ UNCHECKED ←
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=16;OUR EST;→ UNCHECKED ←
DESIG=11

Γ_8	$f_0(1370)\pi, f_0 \rightarrow \pi\pi$	seen
Γ_9	$f_2(1270)\pi, f_2 \rightarrow \pi\pi$	seen
Γ_{10}	$\pi^+\pi^-\pi^0$	seen
Γ_{11}	$\pi^0\pi^0\pi^0$	not seen
Γ_{12}	$KK\pi$	seen
Γ_{13}	$K^*(892)K$	seen
Γ_{14}	$\pi\gamma$	seen

DESIG=12;OUR EST;→ UNCHECKED ←
 DESIG=13;OUR EST;→ UNCHECKED ←
 DESIG=22
 DESIG=23;OUR EST;→ UNCHECKED ←
 DESIG=18;OUR EST;→ UNCHECKED ←
 DESIG=14;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←

$a_1(1260)$ PARTIAL WIDTHS

$\Gamma(\pi\gamma)$

Γ_{14}

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
640 ± 246	ZIELINSKI	84C SPEC	200 $\pi^+Z \rightarrow Z3\pi$

NODE=M010220

NODE=M010W4
 NODE=M010W4

D-wave/S-wave AMPLITUDE RATIO IN DECAY OF $a_1(1260) \rightarrow \rho\pi$

NODE=M010DS

VALUE	DOCUMENT ID	TECN	COMMENT
-0.062 ± 0.020 OUR AVERAGE	Error includes scale factor of 2.3. See the ideogram below.		
$-0.043 \pm 0.009 \pm 0.005$	LINK	07A FOCS	$D^0 \rightarrow \pi^-\pi^+\pi^-\pi^+$
$-0.14 \pm 0.04 \pm 0.07$	¹ CHUNG	02 B852	$18.3 \pi^-\rho \rightarrow \pi^+\pi^-\pi^-\rho$
$-0.10 \pm 0.02 \pm 0.02$	^{2,3} ACKERSTAFF	97R OPAL	$E_{cm}^e = 88-94, \tau \rightarrow 3\pi\nu$
-0.11 ± 0.02	² ALBRECHT	93C ARG	$\tau^+ \rightarrow \pi^+\pi^+\pi^-\nu$

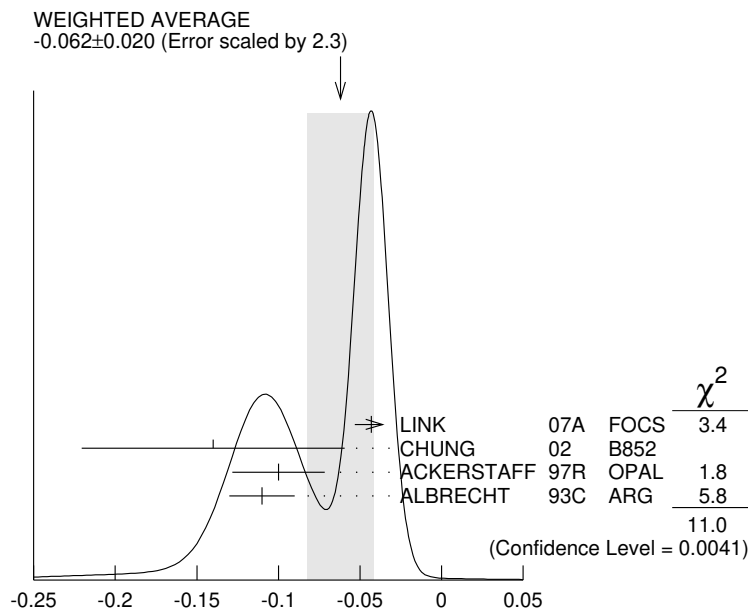
NODE=M010DS

¹ Deck-type background not subtracted.

² Uses the model of ISGUR 89.

³ Supersedes AKERS 95P.

NODE=M010DS;LINKAGE=C
 NODE=M010DS;LINKAGE=IM
 NODE=M010DS;LINKAGE=X



D-wave/S-wave AMPLITUDE RATIO IN DECAY OF $a_1(1260) \rightarrow \rho\pi$

$a_1(1260)$ BRANCHING RATIOS

NODE=M010225

$\Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$

Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
60.19	37k	¹ ASNER	00 CLE2	$10.6 e^+e^- \rightarrow \tau^+\tau^-$, $\tau^- \rightarrow \pi^-\pi^0\pi^0\nu_\tau$

NODE=M010R5
 NODE=M010R5

¹ From a fit to the Dalitz plot.

NODE=M010R5;LINKAGE=B1

$\Gamma((\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.30 \pm 0.60 \pm 0.22$	37k	¹ ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.NODE=M010R6
NODE=M010R6

NODE=M010R6;LINKAGE=B1

 $\Gamma((\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.56 \pm 0.84 \pm 0.32$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.NODE=M010R7
NODE=M010R7NODE=M010R7;LINKAGE=B1
NODE=M010R7;LINKAGE=B2 $\Gamma((\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.04 \pm 1.20 \pm 0.28$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.NODE=M010R8
NODE=M010R8NODE=M010R8;LINKAGE=B1
NODE=M010R8;LINKAGE=B2 $\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$18.76 \pm 4.29 \pm 1.48$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.² Assuming for $f_0(500)$ (σ) mass and width of 860 and 880 MeV respectively.NODE=M010R9
NODE=M010R9NODE=M010R9;LINKAGE=B1
NODE=M010R9;LINKAGE=B3 $\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/[\Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) + \Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi)]$ $\Gamma_6/(\Gamma_2+\Gamma_2)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.06 ± 0.05	90k	SALVINI	04	OBLX $\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
~ 0.3	28k	AKHMETSHIN	99E	CMD2 $1.05\text{--}1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^+ \pi^-$
0.003 ± 0.003		¹ LONGACRE	82	RVUE

¹ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVIL-LET 77, DAUM 80, and DANKOWYCH 81.NODE=M010R4
NODE=M010R4

NODE=M010R4;LINKAGE=E

 $\Gamma(f_0(980)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen		¹ ALEXEEV	21	COMP $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	37k	ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ The $a_1(1260)^- \rightarrow f_0(980)\pi^-$ decay mode via the Triangle Singularity mechanism from MIKHASENKO 15 and ACETI 16 explains the $a_1(1420)^-$ signal observed by ADOLPH 15C.NODE=M010R10
NODE=M010R10

NODE=M010R10;LINKAGE=A

 $\Gamma(f_0(1370)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$7.40 \pm 2.71 \pm 1.26$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.² Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively.NODE=M010R11
NODE=M010R11NODE=M010R11;LINKAGE=B1
NODE=M010R11;LINKAGE=B4

$\Gamma(f_2(1270)\pi, f_2 \rightarrow \pi\pi)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1.19 \pm 0.49 \pm 0.17$	37k	^{1,2} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

¹ From a fit to the Dalitz plot.² Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively. $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	COMMENT
seen	BARBERIS 98B	450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$

 $\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$ Γ_{11}/Γ_{10}

VALUE	CL%	DOCUMENT ID	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
<0.008	90	¹ BARBERIS 01	450 $pp \rightarrow p_f 3\pi^0 p_s$
¹ Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.			

 $\Gamma(K^*(892)K)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2.2 ± 0.5	2255	¹ COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$
8 to 15	205	² DRUTSKOY	02	BELL $B \rightarrow D^{(*)} K^- K^{*0}$
$3.3 \pm 0.5 \pm 0.1$	37k	³ ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-, \tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
2.6 ± 0.3		⁴ BARATE	99R	ALEP $\tau \rightarrow K \bar{K} \pi \nu_\tau$

¹ Using structure functions from KUHN 92 and DECKER 93A and $B(\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau) = (0.155 \pm 0.006 \pm 0.009)\%$ from BRIERE 03.² From a comparison to ALAM 94 assuming purely resonant production of the $K^- K^{*0}$ system.³ From a fit to the 3π mass spectrum including the $K \bar{K}^*(892)$ threshold.⁴ Assuming $a_1(1260)$ dominance and taking $B(\tau \rightarrow a_1(1260) \nu_\tau)$ from BUSKULIC 96. $a_1(1260)$ REFERENCES

ALEXEEV 21	PRL 127 082501	G.D. Alexeev <i>et al.</i>	(COMPASS Collab.)
AAIJ 18A1	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)
AGHASYAN 18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
MIKHASENKO 18	PR D98 096021	M. Mikhasenko <i>et al.</i>	(JPAC Collab.)
DARGENT 17	JHEP 1705 143	P. d'Argent <i>et al.</i>	(HEID, BRIS)
ACETI 16	PR D94 096015	F. Aceti, L.R. Dai, E. Oset	(IFIC, LNUDA)
ADOLPH 15C	PRL 115 082001	C. Adolph <i>et al.</i>	(COMPASS Collab.)
MIKHASENKO 15	PR D91 094015	M. Mikhasenko, B. Ketzer, A. Sarantsev	(BONN+)
ALEKSEEV 10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
AUBERT 07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK 07A	PR D75 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
PDG 06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
COAN 04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GOMEZ-DUM... 04	PR D69 073002	D. Gomez Dumm, A. Pich, J. Portoles	
SALVINI 04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BRIERE 03	PRL 90 181802	R. A. Briere <i>et al.</i>	(CLEO Collab.)
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
DRUTSKOY 02	PL B542 171	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
BARBERIS 01	PL B507 14	D. Barberis <i>et al.</i>	
ASNER 00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN 99E	PL B466 392	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
BARATE 99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)
BONDAR 99	PL B466 403	A.E. Bondar <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABREU 98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
BARATE 98R	EPJ C4 409	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS 98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACKERSTAFF 97R	ZPHY C75 593	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
BUSKULIC 96	ZPHY C70 579	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
AKERS 95P	ZPHY C67 45	R. Akers <i>et al.</i>	(OPAL Collab.)
ALAM 94	PR D50 43	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT 93C	ZPHY C58 61	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DECKER 93A	ZPHY C58 445	R. Decker <i>et al.</i>	
ANDO 92	PL B291 496	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
KUHN 92	ZPHY C56 661	J.H. Kuhn, E. Mirkes	
IVANOV 91	ZPHY C49 563	Y.P. Ivanov, A.A. Osipov, M.K. Volkov	(JINR)
ARMSTRONG 90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
FEINDT 90	ZPHY C48 681	M. Feindt	(HAMB)
KUHN 90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ISGUR 89	PR D39 1357	N. Isgur, C. Morningstar, C. Reader	(TNTO)
BOWLER 88	PL B209 99	M.G. Bowler	(OXF)
BAND 87	PL B198 297	H.R. Band <i>et al.</i>	(MAC Collab.)
TORNQVIST 87	ZPHY C36 695	N.A. Tornqvist	(HELS)
ALBRECHT 86B	ZPHY C33 7	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
RUCKSTUHL 86	PRL 56 2132	W. Ruckstuhl <i>et al.</i>	(DELCO Collab.)
SCHMIDKE 86	PRL 57 527	W.B. Schmidke <i>et al.</i>	(Mark II Collab.)
BELLINI 85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223			
ZIELINSKI 84C	PRL 52 1195	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
LONGACRE 82	PR D26 82	R.S. Longacre	(BNL)
DANKOWY... 81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM 81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM 80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
GAVILLET 77	PL 69B 119	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJ+)
BOWLER 75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M010R12
NODE=M010R12NODE=M010R12;LINKAGE=B1
NODE=M010R12;LINKAGE=B5NODE=M010R00
NODE=M010R00NODE=M010R15
NODE=M010R15

NODE=M010R15;LINKAGE=RB

NODE=M010R13
NODE=M010R13

NODE=M010R13;LINKAGE=CO

NODE=M010R13;LINKAGE=DR

NODE=M010R13;LINKAGE=B6
NODE=M010R13;LINKAGE=BA

NODE=M010

REFID=62008
REFID=59187
REFID=59471
REFID=59487
REFID=58121
REFID=62015
REFID=56790
REFID=56825
REFID=53356
REFID=52049
REFID=51713
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REFID=10350
REFID=47490

REFID=20882
REFID=20878
REFID=20572
REFID=20872
REFID=20868
REFID=20852
REFID=20571

$f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M005

 $f_2(1270)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M005PP

NODE=M005PP

NODE=M005PP

→ UNCHECKED ←

NODE=M005PP;LINKAGE=A

NODE=M005M

NODE=M005M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1260–1283) – i (90–110) OUR ESTIMATE			
$(1268 \pm 8) - i (101 \pm 6)$	RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1263.3 \pm 0.2 \pm 1.5) - i$ $(96.9 \pm 0.2 \pm 0.8)$	ALBRECHT	20	RVUE $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$ $\pi^0K^+K^-$
$(1270 \pm 8) - i (97 \pm 8)$	¹ ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1278 \pm 5) - i (102 \pm 10)$	¹ BERTIN	97c	OBLX $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$

¹ Amplitude did not include dispersive corrections. $f_2(1270)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.4 ± 0.8 OUR AVERAGE Error includes scale factor of 1.1.				
$1275.8 \pm 1.0 \pm 0.4$		¹ BOGOLYUB...	13	SPEC $7\pi^+(K^+,p)A \rightarrow n\gamma + X$
$1262 \pm \frac{1}{2} \pm 8$		² ABLIKIM	06v	BES2 $e^+e^- \rightarrow J/\psi \rightarrow$ $\gamma\pi^+\pi^-$
1275 ± 15		ABLIKIM	05	BES2 $J/\psi \rightarrow \phi\pi^+\pi^-$
1283 ± 5		ALDE	98	GAM4 $100 \pi^- p \rightarrow \pi^0\pi^0 n$
1272 ± 8	200k	PROKOSHKIN	94	GAM2 $38 \pi^- p \rightarrow \pi^0\pi^0 n$
1269.7 ± 5.2	5730	AUGUSTIN	89	DM2 $e^+e^- \rightarrow 5\pi$
1283 ± 8	400	³ ALDE	87	GAM4 $100 \pi^- p \rightarrow 4\pi^0 n$
1274 ± 5		³ AUGUSTIN	87	DM2 $J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		⁴ LONGACRE	86	MPS $22 \pi^- p \rightarrow n2K_S^0$
1276 ± 7		COURAU	84	DLCO $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
1273.3 ± 2.3		⁵ CHABAUD	83	ASPK $17 \pi^- p$ polarized
1280 ± 4		⁶ CASON	82	STRC $8 \pi^+ p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81	MRK2 J/ψ decay
1282 ± 5		⁷ CORDEN	79	OMEG $12-15 \pi^- p \rightarrow n2\pi$
1269 ± 4	10k	APEL	75	NICE $40 \pi^- p \rightarrow n2\pi^0$
1272 ± 4	4600	ENGLER	74	DBC $6 \pi^+ n \rightarrow \pi^+\pi^- p$
1277 ± 4	5300	FLATTE	71	HBC $7.0 \pi^+ p$
1273 ± 8		³ STUNTEBECK	70	HBC $8 \pi^- p, 5.4 \pi^+ d$
1265 ± 8		BOESEBECK	68	HBC $8 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1257 ± 6		⁸ KLEMP	22	RVUE $J/\psi(1S) \rightarrow \gamma\pi^0\pi^0,$ $\gamma K_S^0 K_S^0$
1263 ± 12		CARVER	21	CLAS $\gamma p \rightarrow \pi^0\pi^0 p$
$1259 \pm 4 \pm 4$	1.7k	^{9,10} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
$1267 \pm 4 \pm 3$	1.5k	^{9,10} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1277 ± 6	870	¹¹ SCHEGELSKY	06A	RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$
1251 ± 10		TIKHOMIROV	03	SPEC $40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1260 ± 10		¹² ALDE	97	GAM2 $450 pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		¹² GRYGOREV	96	SPEC $40 \pi^- N \rightarrow K_S^0 K_S^0 X$
1262 ± 11		AGUILAR-...	91	EHS $400 pp$
1275 ± 10		AKER	91	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$
1220 ± 10		BREAKSTONE	90	SFM $pp \rightarrow pp\pi^+\pi^-$
1288 ± 12		ABACHI	86B	HRS $e^+e^- \rightarrow \pi^+\pi^-\pi^0 X$
1284 ± 30	3k	BINON	83	GAM2 $38 \pi^- p \rightarrow n2\eta$
1280 ± 20	3k	APEL	82	CNTR $25 \pi^- p \rightarrow n2\pi^0$
1284 ± 10	16000	DEUTSCH...	76	HBC $16 \pi^+ p$
1258 ± 10	600	TAKAHASHI	72	HBC $8 \pi^- p \rightarrow n2\pi$
1275 ± 13		ARMENISE	70	HBC $9 \pi^+ n \rightarrow p\pi^+\pi^-$
1261 ± 5	1960	³ ARMENISE	68	DBC $5.1 \pi^+ n \rightarrow p\pi^+ MM^-$
1270 ± 10	360	³ ARMENISE	68	DBC $5.1 \pi^+ n \rightarrow p\pi^0 MM$
1268 ± 6		¹³ JOHNSON	68	HBC $3.7-4.2 \pi^- p$

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.
² Breit-Wigner mass.
³ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
⁵ From an energy-independent partial-wave analysis.
⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
⁷ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
⁸ Fit of the tensor partial waves from BES3 in the multipole basis.
⁹ Using CLEO-c data but not authored by the CLEO Collaboration.
¹⁰ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 185$ MeV.
¹¹ From analysis of L3 data at 91 and 183–209 GeV.
¹² Systematic uncertainties not estimated.
¹³ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

NODE=M005M;LINKAGE=B

NODE=M005M;LINKAGE=K
 NODE=M005M;LINKAGE=T
 NODE=M005M;LINKAGE=L
 NODE=M005M;LINKAGE=O
 NODE=M005M;LINKAGE=P
 NODE=M005M;LINKAGE=S
 NODE=M005M;LINKAGE=Q
 NODE=M005M;LINKAGE=C
 NODE=M005M;LINKAGE=D
 NODE=M005M;LINKAGE=SC
 NODE=M005M;LINKAGE=QQ
 NODE=M005M;LINKAGE=J

 $f_2(1270)$ WIDTH

NODE=M005W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M005W

186.6^{+2.8}_{-2.2} OUR FIT Error includes scale factor of 1.5. [186.6 ± 2.3 MeV OUR 2023
 FIT Scale factor = 1.5]

NEW

185.8^{+2.8}_{-2.1} OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

190.3 ± 1.9 ± 1.8		¹ BOGOLYUB...	13	SPEC	$7\pi^+(K^+,p)A \rightarrow n\gamma + X$
175 ⁺⁶ ₋₄ ± 10		² ABLIKIM	06v	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
190 ± 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
171 ± 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$
192 ± 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
180 ± 24		AGUILAR-...	91	EHS	400 pp
169 ± 9	5730	³ AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$
150 ± 30	400	³ ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$
186 ⁺⁹ ₋₂		⁴ LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$
179.2 ^{+6.9} _{-6.6}		⁵ CHABAUD	83	ASPK	17 π^-p polarized
160 ± 11		DENNEY	83	LASS	10 π^+N
196 ± 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$
152 ± 9		⁶ CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
186 ± 27	11600	GIDAL	81	MRK2	J/ψ decay
216 ± 13		⁷ CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$
190 ± 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$
192 ± 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$
183 ± 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$
196 ± 30		³ STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$
216 ± 20	1960	³ ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
128 ± 27		³ BOESEBECK	68	HBC	$8\pi^+p$
176 ± 21		^{3,8} JOHNSON	68	HBC	$3.7-4.2\pi^-p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
168 ± 7		⁹ KLEMP	22	RVUE	$J/\psi(1S) \rightarrow \gamma\pi^0\pi^0,$ $\gamma K_S^0 K_S^0$
183 ± 2		CARVER	21	CLAS	$\gamma p \rightarrow \pi^0\pi^0p$
195 ± 15	870	¹⁰ SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
121 ± 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0 K_S^0 K_L^0 X$
187 ± 20		¹¹ ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$
184 ± 10		¹¹ GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0 K_S^0 X$
200 ± 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$
240 ± 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$
187 ± 30	650	³ ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$
225 ± 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$
166 ± 28	600	³ TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$
173 ± 53		³ ARMENISE	70	HBC	$9\pi^+n \rightarrow p\pi^+\pi^-$

OCCUR=2

OCCUR=2

- ¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.
- ² Breit-Wigner width
- ³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
- ⁴ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.
- ⁵ From an energy-independent partial-wave analysis.
- ⁶ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.
- ⁷ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.
- ⁸ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.
- ⁹ Fit of the tensor partial waves from BES3 in the multipole basis.
- ¹⁰ From analysis of L3 data at 91 and 183–209 GeV.
- ¹¹ Systematic uncertainties not estimated.

NODE=M005W;LINKAGE=C

NODE=M005W;LINKAGE=D

NODE=M005W;LINKAGE=T

NODE=M005W;LINKAGE=L

NODE=M005W;LINKAGE=R

NODE=M005W;LINKAGE=Q

NODE=M005W;LINKAGE=U

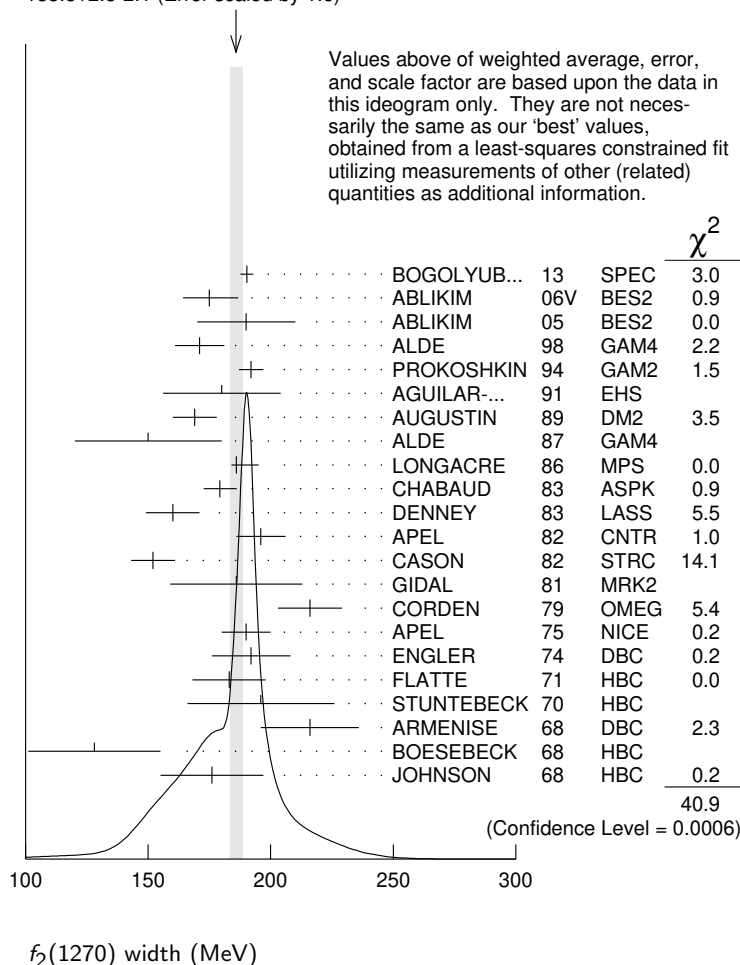
NODE=M005W;LINKAGE=J

NODE=M005W;LINKAGE=M

NODE=M005W;LINKAGE=SC

NODE=M005W;LINKAGE=QQ

WEIGHTED AVERAGE
185.8±2.8-2.1 (Error scaled by 1.6)

 **$f_2(1270)$ DECAY MODES**

NODE=M005215;NODE=M005

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\pi\pi$	$(84.3^{+2.8}_{-1.0})\%$	S=1.2
Γ_2 $\pi^+\pi^-2\pi^0$	$(7.7^{+1.2}_{-3.1})\%$	S=1.2
Γ_3 $K\bar{K}$	$(4.6 \pm 0.4)\%$	S=2.7
Γ_4 $2\pi^+2\pi^-$	$(2.8 \pm 0.4)\%$	S=1.2
Γ_5 $\eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	S=2.1
Γ_6 $4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$	
Γ_7 $\gamma\gamma$	$(1.42 \pm 0.24) \times 10^{-5}$	S=1.4
Γ_8 $\eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%
Γ_9 $K^0 K^- \pi^+ + \text{c.c.}$	$< 3.4 \times 10^{-3}$	CL=95%
Γ_{10} e^+e^-	$< 6 \times 10^{-10}$	CL=90%

DESIG=1

DESIG=3

DESIG=4

DESIG=2

DESIG=7

DESIG=9

DESIG=8

DESIG=6

DESIG=5

DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 4 partial widths, a combination of partial widths obtained from integrated cross sections, and 6 branching ratios uses 44 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 82.3$ for 37 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−91						
x_3	10	−39					
x_4	10	−38	1				
x_5	1	−6	0	0			
x_6	0	−7	0	0	0		
x_7	4	1	−15	0	0	0	
Γ	−72	66	−10	−7	−1	0	−6
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

	Mode	Rate (MeV)		Scale factor	
Γ_1	$\pi\pi$	157.2	$+5.0$ -1.0		DESIG=1
Γ_2	$\pi^+\pi^-2\pi^0$	14.3	$+2.3$ -6.0	1.3	DESIG=3
Γ_3	$K\bar{K}$	8.5	± 0.8	2.8	DESIG=4
Γ_4	$2\pi^+2\pi^-$	5.2	± 0.7	1.2	DESIG=2
Γ_5	$\eta\eta$	0.75	± 0.14	2.1	DESIG=7
Γ_6	$4\pi^0$	0.56	± 0.19		DESIG=9
Γ_7	$\gamma\gamma$	0.0026	± 0.0005	1.4	DESIG=8

$f_2(1270)$ PARTIAL WIDTHS

$\Gamma(\pi\pi)$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

157.2 $^{+5.0}_{-1.0}$ OUR FIT

[157.2 $^{+4.0}_{-1.1}$ MeV OUR 2023 FIT]

157.0 $^{+6.0}_{-1.0}$

¹ LONGACRE 86 MPS $22\pi^-p \rightarrow n2K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

152 ± 8 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

$\Gamma(K\bar{K})$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

8.5 ± 0.8 OUR FIT Error includes scale factor of 2.8.

9.0 $^{+0.7}_{-0.3}$

¹ LONGACRE 86 MPS $22\pi^-p \rightarrow n2K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.5 ± 2.0 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

$\Gamma(\eta\eta)$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	

0.75 ± 0.14 OUR FIT Error includes scale factor of 2.1.

1.0 ± 0.1

¹ LONGACRE 86 MPS $22\pi^-p \rightarrow n2K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.8 ± 0.4 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

NODE=M005220

NODE=M005W1
NODE=M005W1

NEW

NODE=M005W1;LINKAGE=L
NODE=M005W1;LINKAGE=SC

NODE=M005W4
NODE=M005W4

NODE=M005W4;LINKAGE=L
NODE=M005W4;LINKAGE=SC

NODE=M005W7
NODE=M005W7

NODE=M005W7;LINKAGE=L
NODE=M005W7;LINKAGE=SC

$\Gamma(\gamma\gamma)$ Γ_7

The value of this width depends on the theoretical model used. Unitary approaches with scalars typically (with exception of PENNINGTON 08) give values clustering around 2.6 keV; without an S -wave contribution, values are systematically higher (typically around 3 keV).

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ±0.5 OUR FIT	Error includes scale factor of 1.4.			
2.93±0.40		¹ DAI	14A RVUE	Compilation
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.14±0.20		^{2,3} PENNINGTON 08	RVUE	Compilation
3.82±0.30		^{3,4} PENNINGTON 08	RVUE	Compilation
2.55±0.15	870	⁵ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2.84±0.35		BOGLIONE 99	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
2.93±0.23±0.32		⁶ YABUKI 95	VNS	
2.58±0.13 ^{+0.36} _{-0.27}		⁷ BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.10±0.35±0.35		⁸ BLINOV 92	MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.27±0.47±0.11		ADACHI 90D	TOPZ	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.15±0.04±0.39		BOYER 90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.19±0.16 ^{+0.29} _{-0.28}		MARSISKE 90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2.35±0.65		⁹ MORGAN 90	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^-, \pi^0 \pi^0$
3.19±0.09 ^{+0.22} _{-0.38}	2177	OEST 90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
3.2 ±0.1 ±0.4		¹⁰ AIHARA 86B	TPC	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.5 ±0.1 ±0.5		BEHREND 84B	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.85±0.25±0.5		¹¹ BERGER 84	PLUT	$e^+ e^- \rightarrow e^+ e^- 2\pi$
2.70±0.05±0.20		COURAU 84	DLCO	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.52±0.13±0.38		¹² SMITH 84C	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.7 ±0.2 ±0.6		EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
2.9 ^{+0.6} _{-0.4} ±0.6		¹³ EDWARDS 82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\pi^0$
3.2 ±0.2 ±0.6		BRANDELIK 81B	TASS	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.6 ±0.3 ±0.5		ROUSSARIE 81	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
2.3 ±0.8		¹⁴ BERGER 80B	PLUT	$e^+ e^-$

¹ Based on a K -matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis. Supersedes PENNINGTON 08.

² Solution A (preferred solution based on χ^2 -analysis).

³ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁴ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

⁵ From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.

⁶ With a narrow scalar state around 1220 MeV.

⁷ Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.

⁸ Using the unitarized model of LYTH 85.

⁹ Error includes spread of different solutions. Data of MARK2 and CRYSTAL BALL used in the analysis. Authors report strong correlations with $\gamma\gamma$ width of $f_0(1370)$: $\Gamma(f_2) + 1/4 \Gamma(f_0) = 3.6 \pm 0.3$ KeV.

¹⁰ Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.

¹¹ Using the MENNESSIER 83 model.

¹² Superseded by BOYER 90.

¹³ If helicity = 2 assumption is not made.

¹⁴ Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.

 $\Gamma(e^+ e^-)$ Γ_{10}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.11	90	ACHASOV	00K SND	$e^+ e^- \rightarrow \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.7	90	VOROBYEV	88 ND	$e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M005W8

NODE=M005W8

NODE=M005W8

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M005W8;LINKAGE=A

NODE=M005W8;LINKAGE=P1

NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

NODE=M005W8;LINKAGE=SC

NODE=M005W8;LINKAGE=YA

NODE=M005W;LINKAGE=B

NODE=M005W;LINKAGE=A

NODE=M005PW;LINKAGE=C

NODE=M005PW;LINKAGE=B

NODE=M005PW;LINKAGE=X

NODE=M005PW;LINKAGE=V

NODE=M005PW;LINKAGE=H

NODE=M005PW;LINKAGE=A

NODE=M005W9

NODE=M005W9

$f_2(1270) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M005223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_7 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

0.121 ± 0.020 OUR FIT Error includes scale factor of 1.3.**0.091 ± 0.007 ± 0.027**¹ ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.104 ± 0.007 ± 0.072 ² ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ ¹ Using an incoherent background.² Using a coherent background.

OCCUR=2

NODE=M005G1;LINKAGE=A

NODE=M005G1;LINKAGE=K

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_5 \Gamma_7 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

11.5^{+1.8+4.5}_{-2.0-3.7}¹ UEHARA 10A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$ ¹ Including interference with the $f'_2(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_0(Y)$.

NODE=M005G02

NODE=M005G02

NODE=M005G02;LINKAGE=UE

Helicity-0/Helicity-2 RATIO IN $\gamma\gamma \rightarrow f_2(1270) \rightarrow \pi\pi$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT

3.7 ± 0.3^{+15.9}_{-2.9}UEHARA 08A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.5 ± 1.8

¹ DAI 14A RVUE Compilation13 ^{2,3} PENNINGTON 08 RVUE Compilation26 ^{3,4} PENNINGTON 08 RVUE Compilation¹ Based on a K -matrix analysis of BELLE data from MORI 07, UEHARA 08A, UEHARA 09 and UEHARA 13. The width is derived for the pole on the third sheet which is closest to the physical axis.² Solution A (preferred solution based on χ^2 -analysis).³ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.⁴ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

NODE=M005HR0

NODE=M005HR0

OCCUR=2

OCCUR=3

NODE=M005HR0;LINKAGE=A

NODE=M005HR0;LINKAGE=P1

NODE=M005HR0;LINKAGE=P3

NODE=M005HR0;LINKAGE=P2

 $f_2(1270)$ BRANCHING RATIOS

NODE=M005225

 $\Gamma(\pi\pi) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.843^{+0.028}_{-0.010} OUR FIT Error includes scale factor of 1.2. [0.843^{+0.029}_{-0.009} OUR 2023 FIT

Scale factor = 1.2]

0.837 ± 0.020 OUR AVERAGE0.849 ± 0.025 CHABAUD 83 ASPK 17 $\pi^- p$ polarized0.85 ± 0.05 250 BEAUPRE 71 HBC 8 $\pi^+ p \rightarrow \Delta^{++} f_2$ 0.8 ± 0.04 600 OH 70 HBC 1.26 $\pi^- p \rightarrow \pi^+ \pi^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.856 ± 0.001 ± 0.05 ¹ ALBRECHT 20 RVUE 0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$,
 $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$ ¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M005R10

NODE=M005R10

NEW

NODE=M005R10;LINKAGE=A

 $\Gamma(\pi^+ \pi^- 2\pi^0) / \Gamma(\pi\pi)$ Γ_2 / Γ_1 Should be twice $\Gamma(2\pi^+ 2\pi^-) / \Gamma(\pi\pi)$ if decay is $\rho\rho$. (See ASCOLI 68D.)

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.091^{+0.015}_{-0.040} OUR FIT Error includes scale factor of 1.2. [0.091^{+0.014}_{-0.040} OUR 2023 FIT

Scale factor = 1.2]

0.15 ± 0.06 600 EISENBERG 74 HBC 4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.07 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

NODE=M005R2

NODE=M005R2

NODE=M005R2

NEW

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.033±0.001±0.005 ¹ ALBRECHT 20 RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$

¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M005R00
NODE=M005R00

NODE=M005R00;LINKAGE=A

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_3/Γ_1

We average only experiments which either take into account $f_2(1270)$ - $a_2(1320)$ interference explicitly or demonstrate that $a_2(1320)$ production is negligible.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.054^{+0.005}_{-0.006} OUR FIT Error includes scale factor of 2.7.

0.041^{+0.004}_{-0.005} OUR AVERAGE

0.045±0.01	¹ BARGIOTTI	03	OBLX	$\bar{p}p$
0.037 ^{+0.008} _{-0.021}	ETKIN	82B	MPS	23 $\pi^- p \rightarrow n 2K_S^0$
0.045±0.009	CHABAUD	81	ASPK	17 $\pi^- p$ polarized
0.039±0.008	LOVERRE	80	HBC	4 $\pi^- p \rightarrow K\bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.052±0.025	ABLIKIM	04E	BES2	$J/\psi \rightarrow \omega K^+ K^-$
0.036±0.005	² COSTA	80	OMEG	1-2.2 $\pi^- p \rightarrow K^+ K^- n$
0.030±0.005	³ MARTIN	79	RVUE	
0.027±0.009	⁴ POLYCHRO...	79	STRC	7 $\pi^- p \rightarrow n 2K_S^0$
0.025±0.015	EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
0.031±0.012	20 ADERHOLZ	69	HBC	8 $\pi^+ p \rightarrow K^+ K^- \pi^+ p$

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

² Re-evaluated by CHABAUD 83.

³ Includes PAWLICKI 77 data.

⁴ Takes into account the $f_2(1270)$ - $f'_2(1525)$ interference.

NODE=M005R3

NODE=M005R3

NODE=M005R3

NODE=M005R;LINKAGE=BG

NODE=M005R3;LINKAGE=D

NODE=M005R3;LINKAGE=F

NODE=M005R3;LINKAGE=M

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.033±0.005 OUR FIT Error includes scale factor of 1.2.

0.033±0.004 OUR AVERAGE Error includes scale factor of 1.1.

0.024±0.006	160	EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
0.051±0.025	70	EISENBERG	74	HBC	4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$
0.043 ^{+0.007} _{-0.011}	285	¹ LOUIE	74	HBC	3.9 $\pi^- p \rightarrow n f_2$
0.037±0.007	154	ANDERSON	73	DBC	6 $\pi^+ n \rightarrow p f_2$
0.047±0.013		OH	70	HBC	1.26 $\pi^- p \rightarrow \pi^+ \pi^- n$

¹ LOUIE 74 was quoted as 0.065 in PDG 74. Factor 2/3 to go from $\pi^+ \pi^- \rightarrow \pi\pi$ forgotten. Mike L.

NODE=M005R1

NODE=M005R1

NODE=M005R1;LINKAGE=02

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT

4.0±0.8 OUR FIT Error includes scale factor of 2.1.

2.9±0.5 OUR AVERAGE

2.7±0.7	BINON	05	GAMS	33 $\pi^- p \rightarrow \eta\eta n$
2.8±0.7	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
5.2±1.7	BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.0±1.0±2.0 ¹ ALBRECHT 20 RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$

¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M005R7

NODE=M005R7

NODE=M005R7;LINKAGE=A

 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.003±0.001 BARBERIS 00E 450 $pp \rightarrow p_f \eta \eta p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.05	95	EDWARDS	82F	CBAL	$e^+ e^- \rightarrow e^+ e^- 2\eta$
<0.016	95	EMMS	75D	DBC	4 $\pi^+ n \rightarrow p f_2$
<0.09	95	EISENBERG	74	HBC	4.9 $\pi^+ p \rightarrow \Delta^{++} f_2$

NODE=M005R6

NODE=M005R6

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0030 ± 0.0010 OUR FIT**0.003 ± 0.001** 400 ± 50 ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

NODE=M005R11
 NODE=M005R11

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.57 ± 0.01^{+1.39}_{-0.14} UEHARA 08A BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$

NODE=M005R13
 NODE=M005R13

$\Gamma(\eta\pi\pi)/\Gamma(\pi\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.010 95 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

NODE=M005R5
 NODE=M005R5

$\Gamma(K^0 K^- \pi^+ + \text{c.c.})/\Gamma(\pi\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.004 95 EMMS 75D DBC 4 $\pi^+ n \rightarrow p f_2$

NODE=M005R4
 NODE=M005R4

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-10})	CL%	DOCUMENT ID	TECN	COMMENT

<6 90 ACHASOV 00K SND $e^+e^- \rightarrow \pi^0\pi^0$

NODE=M005R12
 NODE=M005R12

$f_2(1270)$ REFERENCES

NODE=M005

KLEMP	22	PL B830 137171	E. Klempt <i>et al.</i>	(BONN)	REFID=61646
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
CARVER	21	PRL 126 082002	M. Carver <i>et al.</i>	(CLAS Collab.)	REFID=61097
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)	REFID=55923
BOGOLYUB...	13	PAN 76 1324	M.Yu. Bogolyubsky <i>et al.</i>	(HYPERON-M Collab.)	REFID=55585
Translated from YAF 76 1389.					
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>		REFID=52303
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52309
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
Translated from YAF 68 998.					
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
Translated from YAF 66 860.					
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
Translated from YAF 62 446.					
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)	REFID=45566
Translated from YAF 59 2187.					
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)	REFID=46384
PROKOSHKIN	94	PD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)	REFID=44094
Translated from DANS 336 613.					
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)	REFID=41858
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)	REFID=41587
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)	REFID=41345
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)	REFID=41362
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)	REFID=41376
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)	REFID=41351
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=41583
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
Translated from YAF 48 436.					

ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)	REFID=20767
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
LYTH	85	JP G11 459	D.H. Lyth		REFID=42169
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20757
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20760
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)	REFID=20758
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)	REFID=20759
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20751
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)	REFID=20393
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20745
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)	REFID=20741
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)	REFID=20388
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=20736
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)	REFID=20382
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>		REFID=40124
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)	REFID=20367
DEUTSCH...	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)	REFID=20721
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
EISENBERG	74	PL 52B 239	Y. Eisenberg <i>et al.</i>	(REHO)	REFID=20715
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
LOUIE	74	PL 48B 385	J. Louie <i>et al.</i>	(SACL, CERN)	REFID=20719
PDG	74	PL 50B 1	V. Chaloupka <i>et al.</i>		REFID=40125
ANDERSON	73	PRL 31 562	J.C. Anderson <i>et al.</i>	(CMU, CASE)	REFID=20710
TAKAHASHI	72	PR D6 1266	K. Takahashi <i>et al.</i>	(TOHOK, PENN, NDAM+)	REFID=20103
BEAUPRE	71	NP B28 77	J.V. Beaupre <i>et al.</i>	(AACH, BERL, CERN)	REFID=20698
FLATTE	71	PL 34B 551	S.M. Flatte <i>et al.</i>	(LBL)	REFID=20700
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)	REFID=20693
OH	70	PR D1 2494	B.Y. Oh <i>et al.</i>	(WISC, TNT0) JP	REFID=20335
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)	REFID=20696
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)	REFID=20687
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)	REFID=20681
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)	REFID=20065
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)	REFID=20668
LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)	REFID=20663
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)	REFID=20657

NODE=M008

 $f_1(1285)$

$$J^G(J^{PC}) = 0^+(1^{++})$$

 $f_1(1285)$ MASS

NODE=M008M

NODE=M008M

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1281.8 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below. [1281.9 ± 0.5 MeV OUR 2023 AVERAGE Scale factor = 1.8]		
1280.2 ± 0.6 $^{+1.2}_{-1.5}$	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1281.0 ± 0.8		DICKSON	16 CLAS	$2.55 \gamma p \rightarrow \eta \pi^+ \pi^- p$
1287.4 ± 3.0	87	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
1281.16 ± 0.39 ± 0.45		¹ LEES	12X BABR	$\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$
1285.1 ± 1.0 $^{+1.6}_{-0.3}$		² ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
1281 ± 2 ± 1		AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
1276.1 ± 8.1 ± 8.0	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
1274 ± 6	237	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1280 ± 4		ACCIARRI	01G L3	
1288 ± 4 ± 5	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1284 ± 6	1400	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1281 ± 1		BARBERIS	97B OMEG	$450 p p \rightarrow p p 2(\pi^+ \pi^-)$
1281 ± 1		BARBERIS	97C OMEG	$450 p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
1280 ± 2		³ ANTINORI	95 OMEG	$300,450 p p \rightarrow p p 2(\pi^+ \pi^-)$
1282.2 ± 1.5		LEE	94 MPS2	$18 \pi^- p \rightarrow K^+ \bar{K}^0 2\pi^- p$
1279 ± 5		FUKUI	91C SPEC	$8.95 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1278 ± 2	140	ARMSTRONG	89 OMEG	$300 p p \rightarrow K \bar{K} \pi p p$
1278 ± 2		ARMSTRONG	89G OMEG	$85 \pi^+ p \rightarrow 4\pi \pi p,$ $p p \rightarrow 4\pi p p$
1280.1 ± 2.1	60	RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1285 ± 1	4750	⁴ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1280 ± 1	504	BITYUKOV	88 SPEC	$32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$
1280 ± 4		ANDO	86 SPEC	$8 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1277 ± 2	420	REEVES	86 SPEC	$6.6 p \bar{p} \rightarrow K K \pi X$
1285 ± 2		CHUNG	85 SPEC	$8 \pi^- p \rightarrow N K \bar{K} \pi$
1279 ± 2	604	ARMSTRONG	84 OMEG	$85 \pi^+ p \rightarrow K \bar{K} \pi \pi p,$ $p p \rightarrow K \bar{K} \pi p p$
1286 ± 1		CHAUVAT	84 SPEC	ISR 31.5 $p p$
1278 ± 4		EVANGELIS...	81 OMEG	$12 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1283 ± 3	103	DIONISI	80 HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1282 ± 2	320	NACASCH	78 HBC	$0.7, 0.76 \bar{p} p \rightarrow K \bar{K} 3\pi$
1279 ± 5	210	GRASSLER	77 HBC	$16 \pi^\mp p$
1286 ± 3	180	DUBOC	72 HBC	$1.2 \bar{p} p \rightarrow 2K 4\pi$
1283 ± 5		DAHL	67 HBC	$1.6-4.2 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1289.3 ± 2.8	234	ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$
1284.2 ± 2.2		⁵ AAIJ	14Y LHCB	$\bar{B}_{(s)}^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$
1281.9 ± 0.5		⁵ SOSA	99 SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1282.8 ± 0.6		⁵ SOSA	99 SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
1270 ± 10		AMELIN	95 VES	$37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$
1280 ± 2		ABATZIS	94 OMEG	$450 p p \rightarrow p p 2(\pi^+ \pi^-)$
1282 ± 4		ARMSTRONG	93C E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1270 ± 6 ± 10		ARMSTRONG	92C OMEG	$300 p p \rightarrow p p \pi^+ \pi^- \gamma$
1281 ± 1		ARMSTRONG	89E OMEG	$300 p p \rightarrow p p 2(\pi^+ \pi^-)$
1279 ± 6 ± 10	16	BECKER	87 MRK3	$e^+ e^- \rightarrow \phi K \bar{K} \pi$

OCCUR=2

1286 ± 9		GIDAL	87	MRK2	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
1287 ± 5	353	BITYUKOV	84B	SPEC	$32\pi^-p \rightarrow K^+K^-\pi^0n$
~ 1279		⁶ TORNQVIST	82B	RVUE	
1275 ± 6	31	BROMBERG	80	SPEC	$100\pi^-p \rightarrow K\bar{K}\pi X$
1288 ± 9	200	GURTU	79	HBC	$4.2K^-p \rightarrow n\eta 2\pi$
~ 1275.0	46	⁷ STANTON	79	CNTR	$8.5\pi^-p \rightarrow n2\gamma 2\pi$
1271 ± 10	34	CORDEN	78	OMEG	$12-15\pi^-p \rightarrow K^+K^-\pi n$
1295 ± 12	85	CORDEN	78	OMEG	$12-15\pi^-p \rightarrow n5\pi$
1292 ± 10	150	DEFOIX	72	HBC	$0.7\bar{p}p \rightarrow 7\pi$
1280 ± 3	500	⁸ THUN	72	MMS	$13.4\pi^-p$
1303 ± 8		BARDADIN-...	71	HBC	$8\pi^+p \rightarrow p6\pi$
1283 ± 6		BOESEBECK	71	HBC	$16.0\pi p \rightarrow p5\pi$
1270 ± 10		CAMPBELL	69	DBC	$2.7\pi^+d$
1285 ± 7		LORSTAD	69	HBC	$0.7\bar{p}p, 4,5\text{-body}$
1290 ± 7		D'ANDLAU	68	HBC	$1.2\bar{p}p, 5-6\text{ body}$

OCCUR=2

¹ Using the $2\pi^+2\pi^-$ and $\pi^+\pi^-\eta$ modes of $f_1(1285)$ decay.² The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.³ Supersedes ABATZIS 94, ARMSTRONG 89E.⁴ From partial wave analysis of $K^+\bar{K}^0\pi^-$ system.⁵ No systematic error given.⁶ From a unitarized quark-model calculation.⁷ From phase shift analysis of $\eta\pi^+\pi^-$ system.⁸ Seen in the missing mass spectrum.

NODE=M008M;LINKAGE=LE

NODE=M008M;LINKAGE=BL

NODE=M008M;LINKAGE=B

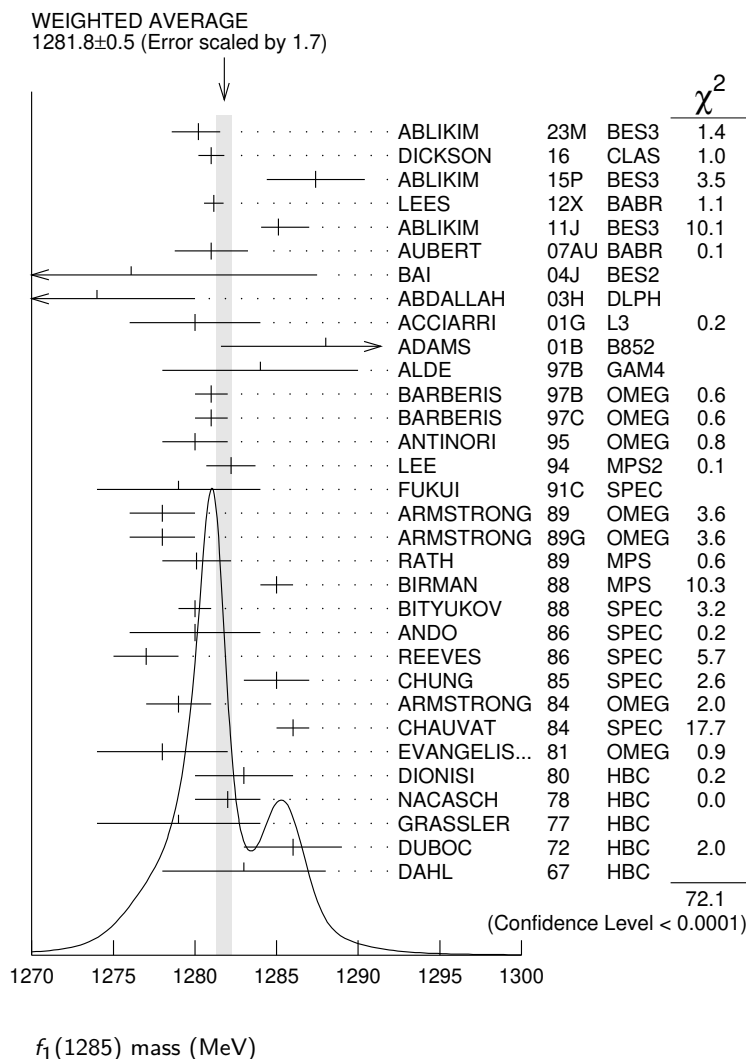
NODE=M008M;LINKAGE=A

NODE=M008M;LINKAGE=N1

NODE=M008M;LINKAGE=T

NODE=M008M;LINKAGE=P

NODE=M008M;LINKAGE=S

 **$f_1(1285)$ WIDTH**

NODE=M008W

Only experiments giving width error less than 20 MeV are kept for averaging.

NODE=M008W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
23.0 ± 1.1 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below. [22.7 ± 1.1 MeV OUR 2023 AVERAGE Scale factor = 1.5]				
28.2 ± 1.1 ⁺ _{-2.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
18.4 ± 1.4		DICKSON	16 CLAS	2.55 $\gamma p \rightarrow \eta \pi^+ \pi^- p$
18.3 ± 6.3	87	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
22.0 ± 3.1 ⁺ _{-1.5}		¹ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
35 ± 6 ± 4		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow f_1(1285) \pi^+ \pi^- \gamma$
40.0 ± 8.6 ± 9.3	203	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
29 ± 12	237	ABDALLAH	03H DLPH	91.2 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
45 ± 9 ± 7	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
55 ± 18	1400	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
24 ± 3		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
20 ± 2		BARBERIS	97C OMEG	450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
36 ± 5		² ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$
29.0 ± 4.1		LEE	94 MPS2	18 $\pi^- p \rightarrow K^+ \bar{K}^0 2\pi^- p$
25 ± 4	140	ARMSTRONG	89 OMEG	300 $pp \rightarrow K \bar{K} \pi pp$
22 ± 2	4750	³ BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
25 ± 4	504	BITYUKOV	88 SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$
19 ± 5		ANDO	86 SPEC	8 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
32 ± 8	420	REEVES	86 SPEC	6.6 $p \bar{p} \rightarrow K K \pi X$
22 ± 2		CHUNG	85 SPEC	8 $\pi^- p \rightarrow N K \bar{K} \pi$
32 ± 3	604	ARMSTRONG	84 OMEG	85 $\pi^+ p \rightarrow K \bar{K} \pi p$, $pp \rightarrow K \bar{K} \pi pp$
24 ± 3		CHAUVAT	84 SPEC	ISR 31.5 pp
29 ± 10	103	DIONISI	80 HBC	4 $\pi^- p \rightarrow K \bar{K} \pi n$
28.3 ± 6.7	320	NACASCH	78 HBC	0.7, 0.76 $\bar{p} p \rightarrow K \bar{K} 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

17.1 ± 3.4	234	ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$
32.4 ± 5.8		⁴ AAIJ	14Y LHCb	$\bar{B}_{(s)}^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$
18.2 ± 1.2		⁴ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-)$ p_{fast}
19.4 ± 1.5		⁴ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+)$ p_{fast}
40 ± 5		ABATZIS	94 OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
31 ± 5		ARMSTRONG	89E OMEG	300 $pp \rightarrow pp2(\pi^+ \pi^-)$
41 ± 12		ARMSTRONG	89G OMEG	85 $\pi^+ p \rightarrow 4\pi \pi p$, $pp \rightarrow 4\pi pp$
17.9 ± 10.9	60	RATH	89 MPS	21.4 $\pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
14 ⁺²⁰ ₋₁₄ ± 10	16	BECKER	87 MRK3	$e^+ e^- \rightarrow \phi K \bar{K} \pi$
26 ± 12		EVANGELIS...	81 OMEG	12 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
25 ± 15	200	GURTU	79 HBC	4.2 $K^- p \rightarrow n \eta 2\pi$
~ 10		⁵ STANTON	79 CNTR	8.5 $\pi^- p \rightarrow n 2\gamma 2\pi$
24 ± 18	210	GRASSLER	77 HBC	16 $\pi^\mp p$
28 ± 5	150	⁶ DEFOIX	72 HBC	0.7 $\bar{p} p \rightarrow 7\pi$
46 ± 9	180	⁶ DUBOC	72 HBC	1.2 $\bar{p} p \rightarrow 2K 4\pi$
37 ± 5	500	⁷ THUN	72 MMS	13.4 $\pi^- p$
10 ± 10		BOESEBECK	71 HBC	16.0 $\pi p \rightarrow p 5\pi$
30 ± 15		CAMPBELL	69 DBC	2.7 $\pi^+ d$
60 ± 15		⁶ LORSTAD	69 HBC	0.7 $\bar{p} p$, 4,5-body
35 ± 10		⁶ DAHL	67 HBC	1.6–4.2 $\pi^- p$

¹ The selected process is $J/\psi \rightarrow \omega a_0(980) \pi$.

² Supersedes ABATZIS 94, ARMSTRONG 89E.

³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ system.

⁴ No systematic error given.

⁵ From phase shift analysis of $\eta \pi^+ \pi^-$ system.

⁶ Resolution is not unfolded.

⁷ Seen in the missing mass spectrum.

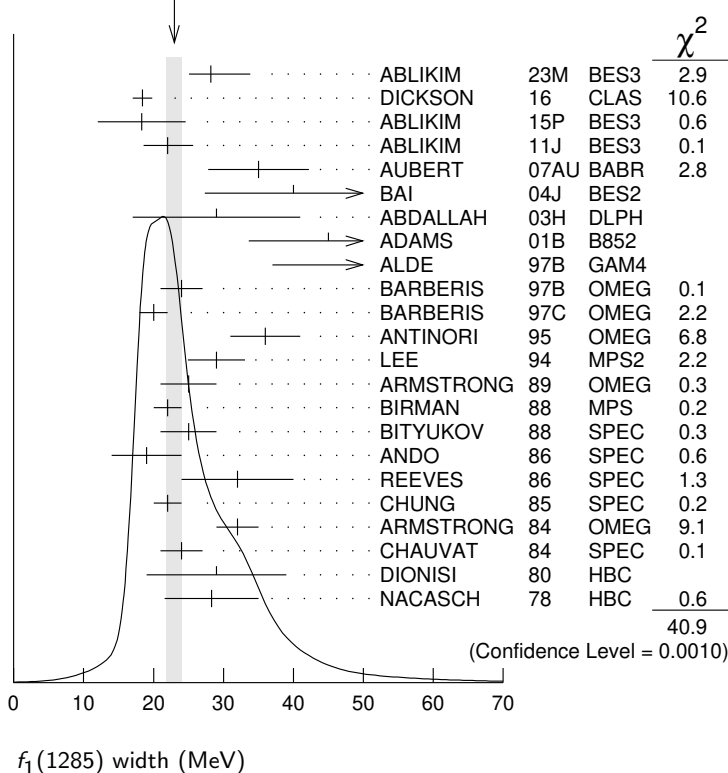
NODE=M008W

NEW

OCCUR=2

NODE=M008W;LINKAGE=BL
NODE=M008W;LINKAGE=B
NODE=M008W;LINKAGE=A
NODE=M008W;LINKAGE=N1
NODE=M008W;LINKAGE=P
NODE=M008W;LINKAGE=R
NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
23.0±1.1 (Error scaled by 1.6)



$f_1(1285)$ DECAY MODES

NODE=M008215;NODE=M008

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 4π	$(32.7 \pm 1.8) \%$	$S=1.2$	DESIG=21
Γ_2 $\pi^0 \pi^0 \pi^+ \pi^-$	$(21.8 \pm 1.2) \%$	$S=1.2$	DESIG=22
Γ_3 $2\pi^+ 2\pi^-$	$(10.9 \pm 0.6) \%$	$S=1.2$	DESIG=20
Γ_4 $\rho^0 \pi^+ \pi^-$	$(10.9 \pm 0.6) \%$	$S=1.2$	DESIG=191
Γ_5 $\rho^0 \rho^0$	seen		DESIG=23
Γ_6 $4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	DESIG=7
Γ_7 $\eta \pi^+ \pi^-$	$(35 \pm 15) \%$		DESIG=198
Γ_8 $\eta \pi \pi$	$(52.2 \pm 1.9) \%$	$S=1.2$	DESIG=3
Γ_9 $a_0(980) \pi$ [ignoring $a_0(980) \rightarrow K \bar{K}$]	$(38 \pm 4) \%$		DESIG=4
Γ_{10} $\eta \pi \pi$ [excluding $a_0(980) \pi$]	$(14 \pm 4) \%$		DESIG=5
Γ_{11} $K \bar{K} \pi$	$(9.0 \pm 0.4) \%$	$S=1.1$	DESIG=1
Γ_{12} $K \bar{K}^*(892)$	not seen		DESIG=6
Γ_{13} $\pi^+ \pi^- \pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$		DESIG=197
Γ_{14} $\rho^\pm \pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%	DESIG=199
Γ_{15} $\gamma \rho^0$	$(6.1 \pm 1.0) \%$	$S=1.7$	DESIG=13
Γ_{16} $\phi \gamma$	$(7.4 \pm 2.6) \times 10^{-4}$		DESIG=10
Γ_{17} $e^+ e^-$	$< 9.4 \times 10^{-9}$	CL=90%	DESIG=200
Γ_{18} $\gamma \gamma^*$			DESIG=9
Γ_{19} $\gamma \gamma$			DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 18 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 24.0$ for 14 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_9	-29			
x_{10}	-12	-89		
x_{11}	22	-9	-4	
x_{15}	-24	-8	-3	-27
	x_1	x_9	x_{10}	x_{11}

$f_1(1285) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M008217

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_{19} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{19} / \Gamma$		
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

NODE=M008G2
NODE=M008G2

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$		$\Gamma_8 \Gamma_{18} / \Gamma = (\Gamma_9 + \Gamma_{10}) \Gamma_{18} / \Gamma$		
VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
1.4 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.4.		
1.18 $\pm 0.25 \pm 0.20$	26	^{1,2} AIHARA	88B	TPC $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
2.30 $\pm 0.61 \pm 0.42$		^{1,3} GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.8 $\pm 0.3 \pm 0.3$	420	⁴ ACHARD	02B	L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

NODE=M008G3
NODE=M008G3¹ Assuming a ρ -pole form factor.² Published value multiplied by $\eta\pi\pi$ branching ratio 0.49.³ Published value divided by 2 and multiplied by the $\eta\pi\pi$ branching ratio 0.49.⁴ Published value multiplied by the $\eta\pi\pi$ branching ratio 0.52.NODE=M008G3;LINKAGE=A
NODE=M008G3;LINKAGE=F
NODE=M008G3;LINKAGE=B
NODE=M008G3;LINKAGE=AC

$f_1(1285)$ BRANCHING RATIOS

NODE=M008220

$\Gamma(K\bar{K}\pi)/\Gamma(4\pi)$				Γ_{11}/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.274±0.017 OUR FIT	Error includes scale factor of 1.4.		[0.274 ± 0.017 OUR 2023 FIT	
Scale factor = 1.4]				

NODE=M008R1
NODE=M008R1
NEW

0.271 ± 0.016 OUR AVERAGE	Error includes scale factor of 1.2.			
0.265 ± 0.014	¹ BARBERIS	97C	OMEG 450	$p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
0.28 ± 0.05	² ARMSTRONG	89E	OMEG 300	$p p \rightarrow p p f_1(1285)$
0.37 $\pm 0.03 \pm 0.05$	³ ARMSTRONG	89G	OMEG 85	$\pi p \rightarrow 4\pi X$

¹ Using $2(\pi^+ \pi^-)$ data from BARBERIS 97B.² Assuming $\rho\pi\pi$ and $a_0(980)\pi$ intermediate states.³ 4π consistent with being entirely $\rho\pi\pi$.NODE=M008R1;LINKAGE=B
NODE=M008R1;LINKAGE=M
NODE=M008R1;LINKAGE=A

$\Gamma(\pi^0\pi^0\pi^+\pi^-)/\Gamma_{\text{total}}$		$\Gamma_2/\Gamma = \frac{2}{3}\Gamma_1/\Gamma$
VALUE	DOCUMENT ID	
0.218±0.012 OUR FIT	Error includes scale factor of 1.2.	[0.218 ± 0.013 OUR 2023 FIT
Scale factor = 1.2]		

NODE=M008R18
NODE=M008R18
NEW

$\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$		$\Gamma_3/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$
VALUE	DOCUMENT ID	
0.109±0.006 OUR FIT	Error includes scale factor of 1.2.	[0.109 ± 0.006 OUR 2023 FIT
Scale factor = 1.2]		

NODE=M008R17
NODE=M008R17
NEW

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$		$\Gamma_4/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$	
VALUE	DOCUMENT ID		
0.109±0.006 OUR FIT	Error includes scale factor of 1.2.	[0.109±0.006 OUR 2023 FIT	
Scale factor = 1.2]			

NODE=M008R19
NODE=M008R19
NEW

$$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma(2\pi^+ 2\pi^-)$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.0 ± 0.4	GRASSLER	77	HBC	16 GeV $\pi^\pm p$

 Γ_4/Γ_3

NODE=M008R6
NODE=M008R6

$$\Gamma(\rho^0 \rho^0) / \Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	COMMENT

seen BARBERIS 00C 450 $pp \rightarrow p_f 4\pi p_s$

 Γ_5/Γ

NODE=M008R21
NODE=M008R21

$$\Gamma(4\pi^0) / \Gamma_{\text{total}}$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<7 90 ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_6/Γ

NODE=M008R8
NODE=M008R8

$$\Gamma(\pi^+ \pi^- \pi^0) / \Gamma(\eta \pi^+ \pi^-)$$

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

0.86 ± 0.16 ± 0.20 2.3k ¹ DOROFEEV 11 VES $\pi^- N \rightarrow \pi^- f_1(1285) N$

 Γ_{13}/Γ_7

NODE=M008R02
NODE=M008R02

¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+ \pi^-$ mass spectrum.

NODE=M008R02;LINKAGE=DO

$$\Gamma(\eta \pi \pi) / \Gamma_{\text{total}}$$

 $\Gamma_8/\Gamma = (\Gamma_9 + \Gamma_{10})/\Gamma$

VALUE	DOCUMENT ID
0.522 ± 0.019 OUR FIT	Error includes scale factor of 1.2. [0.522 ± 0.020 OUR 2023 FIT Scale factor = 1.2]

NODE=M008R22
NODE=M008R22
NEW

$$\Gamma(4\pi) / \Gamma(\eta \pi \pi)$$

 $\Gamma_1/\Gamma_8 = \Gamma_1/(\Gamma_9 + \Gamma_{10})$

VALUE	DOCUMENT ID	TECN	COMMENT

0.63 ± 0.06 OUR FIT Error includes scale factor of 1.2. [0.63 ± 0.06 OUR 2023 FIT Scale factor = 1.3]

NODE=M008R4
NODE=M008R4
NEW

0.41 ± 0.14 OUR AVERAGE

0.37 ± 0.11 ± 0.11 BOLTON 92 MRK3 $J/\psi \rightarrow \gamma f_1(1285)$

0.64 ± 0.40 GURTU 79 HBC 4.2 $K^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.93 ± 0.30 ¹ GRASSLER 77 HBC 16 $\pi^\mp p$

¹ Assuming $\rho \pi \pi$ and $a_0(980) \pi$ intermediate states.

NODE=M008R4;LINKAGE=M

$$\Gamma(2\pi^+ 2\pi^-) / \Gamma(\eta \pi \pi)$$

 Γ_3/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT

0.28 ± 0.02 ± 0.02 ¹ LEES 12X BABR $\tau^- \rightarrow \pi^- f_1(1285) \nu_\tau$

NODE=M008R04
NODE=M008R04

¹ Assuming $B(f_1(1285) \rightarrow \pi \pi \eta) = 3/2 B(f_1(1285) \rightarrow \pi^+ \pi^- \eta)$.

NODE=M008R04;LINKAGE=LE

$$\Gamma(a_0(980) \pi [\text{ignoring } a_0(980) \rightarrow K \bar{K}]) / \Gamma(\eta \pi \pi)$$

 $\Gamma_9/\Gamma_8 = \Gamma_9/(\Gamma_9 + \Gamma_{10})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.72 ± 0.08 OUR FIT

0.72 ± 0.07 OUR AVERAGE

0.74 ± 0.02 ± 0.09 DICKSON 16 CLAS $\gamma p \rightarrow f_1(1285) p$

0.72 ± 0.15 GURTU 79 HBC 4.2 $K^- p$

0.6 ^{+0.3}_{-0.2} CORDEN 78 OMEG 12-15 $\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.69 95 ACHARD 02B L3 183-209 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$

0.28 ± 0.07 ALDE 97B GAM4 100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$

1.0 ± 0.3 GRASSLER 77 HBC 16 $\pi^\mp p$

NODE=M008R3
NODE=M008R3

$$\Gamma(K \bar{K} \pi) / \Gamma(\eta \pi \pi)$$

 $\Gamma_{11}/\Gamma_8 = \Gamma_{11}/(\Gamma_9 + \Gamma_{10})$

VALUE	DOCUMENT ID	TECN	COMMENT

0.172 ± 0.011 OUR FIT
[0.172 ± 0.012 OUR 2023 FIT Scale factor = 1.1]

0.176 ± 0.012 OUR AVERAGE

0.216 ± 0.010 ± 0.031 DICKSON 16 CLAS $\gamma p \rightarrow f_1(1285) p$

0.166 ± 0.01 ± 0.008 BARBERIS 98C OMEG 450 $pp \rightarrow p_f f_1(1285) p_s$

0.42 ± 0.15 GURTU 79 HBC 4.2 $K^- p$

0.5 ± 0.2 ¹ CORDEN 78 OMEG 12-15 $\pi^- p$

0.20 ± 0.08 ² DEFOIX 72 HBC 0.7 $\bar{p} p \rightarrow 7\pi$

0.16 ± 0.08 CAMPBELL 69 DBC 2.7 $\pi^+ d$

NODE=M008R2
NODE=M008R2
NEW

OCCUR=2

¹ CORDEN 78 assumes low-mass $\eta \pi \pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.

NODE=M008R2;LINKAGE=CD

² $K \bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).

NODE=M008R2;LINKAGE=K

$\Gamma(K\bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	NACASCH 78	HBC	$0.7, 0.76 \bar{p}p \rightarrow K\bar{K}3\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	¹ ACHARD 07	L3	$183-209 e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$

¹ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.055±0.074	2.3k	¹ DOROFEEV 11	VES	$\pi^-N \rightarrow \pi^-f_1(1285)N$

¹ Value obtained selecting the region corresponding to $f_0(980)$ in the $\pi^+\pi^-$ mass spectrum. The systematic error includes the uncertainty on the partial width $f_1 \rightarrow \eta\pi\pi$ obtained from PDG 10 data.NODE=M008R01
NODE=M008R01

NODE=M008R01;LINKAGE=DO

 $\Gamma(\rho^\pm\pi^\mp)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	95	DOROFEEV 11	VES	$\pi^-N \rightarrow \pi^-f_1(1285)N$

NODE=M008R03
NODE=M008R03 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
6.1±1.0 OUR FIT				Error includes scale factor of 1.7. $[(6.1 \pm 1.0) \times 10^{-2}]$ OUR 2023 FIT Scale factor = 1.7]

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.8±0.7±0.6	¹ AMELIN 95	VES	37	$\pi^-N \rightarrow \pi^-\pi^+\pi^-\gamma N$
<5	95	BITYUKOV 91B	SPEC	32 $\pi^-p \rightarrow \pi^+\pi^-\gamma n$

¹ Not an independent measurement.NODE=M008R15
NODE=M008R15

NEW

NODE=M008R15;LINKAGE=A

 $\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$ $\Gamma_{15}/\Gamma_3 = \Gamma_{15}/\frac{1}{3}\Gamma_1$

VALUE	DOCUMENT ID	TECN	COMMENT
0.55±0.10 OUR FIT			Error includes scale factor of 1.5.
0.45±0.18	¹ COFFMAN 90	MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma 2\pi^+ 2\pi^-) = 0.55 \times 10^{-4}$ given by MIR 88.NODE=M008R13
NODE=M008R13

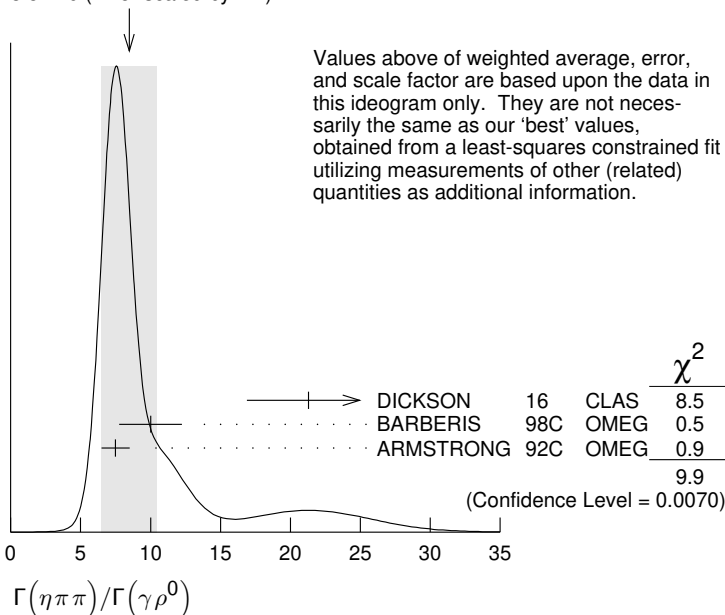
NODE=M008R13;LINKAGE=E

 $\Gamma(\eta\pi\pi)/\Gamma(\gamma\rho^0)$ $\Gamma_8/\Gamma_{15} = (\Gamma_9 + \Gamma_{10})/\Gamma_{15}$

VALUE	DOCUMENT ID	TECN	COMMENT
8.6±1.6 OUR FIT			Error includes scale factor of 1.9.
8.5±2.0 OUR AVERAGE			Error includes scale factor of 2.2. See the ideogram below.
21.3±4.4	DICKSON 16	CLAS	$\gamma p \rightarrow f_1(1285)p$
10.0±1.0±2.0	BARBERIS 98C	OMEG	450 $pp \rightarrow p_f f_1(1285)p_s$
7.5±1.0	¹ ARMSTRONG 92C	OMEG	300 $pp \rightarrow p\rho\pi^+\pi^-\gamma, p\rho\eta\pi^+\pi^-$

¹ Published value multiplied by 1.5.NODE=M008R16
NODE=M008R16

NODE=M008R16;LINKAGE=B

WEIGHTED AVERAGE
8.5±2.0 (Error scaled by 2.2)

$\Gamma(\gamma\rho^0)/\Gamma(K\bar{K}\pi)$ Γ_{15}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
>0.035	90	¹ COFFMAN	90	MRK3 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
¹ Using $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma\gamma\rho^0) = 0.25 \times 10^{-4}$ and $B(J/\psi \rightarrow \gamma f_1(1285) \rightarrow \gamma K\bar{K}\pi) < 0.72 \times 10^{-3}$.				

NODE=M008R12
 NODE=M008R12

NODE=M008R12;LINKAGE=F

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{16}/Γ_{11}

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.82±0.21±0.20	19		BITYUKOV	88	SPEC $32.5 \pi^- p \rightarrow K^+ K^- \pi^0 n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.50	95		BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285) p_s$
<0.93	95		AMELIN	95	VES $37 \pi^- N \rightarrow \pi^- \pi^+ \pi^- \gamma N$

NODE=M008R9
 NODE=M008R9

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9.4 × 10⁻⁹	90	¹ ACHASOV	20	SND $e^+e^- \rightarrow \eta\pi^0\pi^0$
¹ ACHASOV 20 reports two candidate events corresponding to a significance of 2.5 σ and the branching fraction of $(5.1^{+3.7}_{-2.7}) \times 10^{-9}$.				

NODE=M008R00
 NODE=M008R00

OCCUR=2

NODE=M008R00;LINKAGE=B

 $f_1(1285)$ REFERENCES

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	20	PL B800 135074	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DICKSON	16	PR C93 065202	R. Dickson <i>et al.</i>	(JLab CLAS Collab.)
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAJ	14Y	PRL 112 091802	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	12X	PR D86 092010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)
PDG	10	JP G37 075021	K. Nakamura <i>et al.</i>	(PDG Collab.)
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>	
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 60 458.				
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
AMELIN	95	ZPHY C66 71	D.V. Amelin <i>et al.</i>	(VES Collab.)
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)
BITYUKOV	91B	SJNP 54 318	S.I. Bityukov <i>et al.</i>	(SERP)
Translated from YAF 54 529.				
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD)
BITYUKOV	88	PL B203 327	S.I. Bityukov <i>et al.</i>	(SERP)
MIR	88	Photon-Photon 88, 126	R. Mir	(Mark III Collab.)
Conference				
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+)
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+)
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)
BITYUKOV	84B	PL 144B 133	S.I. Bityukov <i>et al.</i>	(SERP)
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+)
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+)
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
NACASCH	78	NP B135 203	R. Nacasch <i>et al.</i>	(PARIS, MADR, CERN)
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)
DUBOC	72	NP B46 429	J. Duboc <i>et al.</i>	(PARIS, LIVP)
THUN	72	PRL 28 1733	R. Thun <i>et al.</i>	(STON, NEAS)
BARDADIN...	71	PR D4 2711	M. Bardadin-Otwinowska <i>et al.</i>	(WARS)
BOESEBECK	71	PL 34B 659	K. Boesebeck	(AACH, BERL, BONN, CERN, CRAC+)
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)
LORSTAD	69	NP B14 63	B. Lorstad <i>et al.</i>	(CDEF, CERN) JP
D'ANDLAU	68	NP B5 693	C. d'Andlau <i>et al.</i>	(CDEF, CERN, IRAD+)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP

NODE=M008

REFID=62055
 REFID=60144
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$\eta(1295)$

$$I^G(J^{PC}) = 0^+(0^{-+})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M037

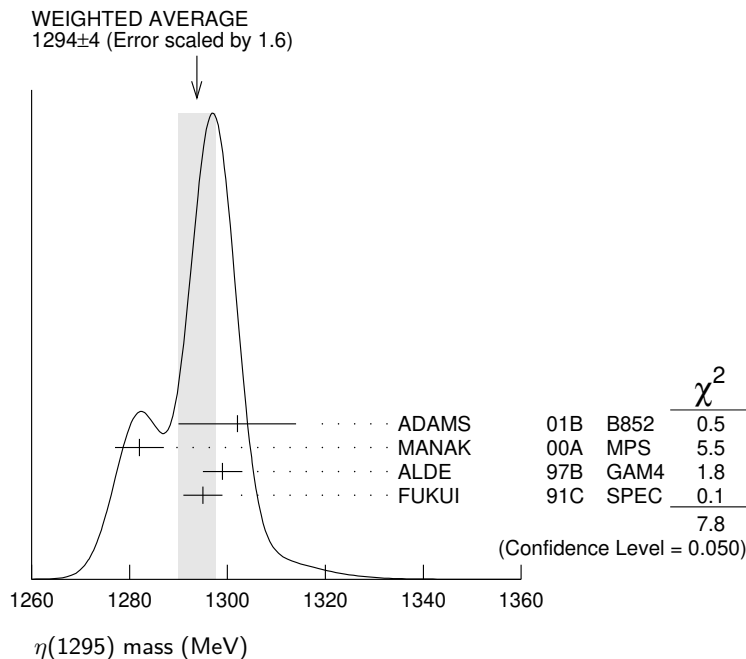
NODE=M037

NODE=M037M

NODE=M037M

 $\eta(1295)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1294±4 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
1302±9±8	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1282±5	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1299±4	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1295±4		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1264±8		¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 1275		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$



¹ PWA analysis of AUGUSTIN 92 assigns 0^{-+} quantum numbers to this state rather than 1^{++} as before.

NODE=M037M;LINKAGE=AG

 $\eta(1295)$ WIDTH

NODE=M037W

NODE=M037W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
55± 5 OUR AVERAGE				
57±23±21	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
66±13	9082	MANAK	00A MPS	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
53± 6		FUKUI	91C SPEC	8.95 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<40	2100	ALDE	97B GAM4	100 $\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
44±20		¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 70		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$

¹ PWA analysis of AUGUSTIN 92 assigns 0^{-+} quantum numbers to this state rather than 1^{++} as before.

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi^+\pi^-$	seen
Γ_2 $a_0(980)\pi$	seen
Γ_3 $\gamma\gamma$	
Γ_4 $\eta\pi^0\pi^0$	seen
Γ_5 $\eta(\pi\pi)S\text{-wave}$	seen
Γ_6 $\sigma\eta$	seen
Γ_7 $K\bar{K}\pi$	seen

NODE=M037215;NODE=M037

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←

 $\eta(1295)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.066	95	ACCIARRI	01G L3	183-202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$	

NODE=M037220

NODE=M037G2
 NODE=M037G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AIHARA	88C TPC	$e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$
<0.3		ANTREASYAN	87 CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi\pi$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_7\Gamma_3/\Gamma$
VALUE (keV)	CL%
DOCUMENT ID	TECN
COMMENT	

NODE=M037G3
 NODE=M037G3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.014	90	1,2 AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$

¹ Using $\eta(1295)$ mass and width 1294 MeV and 55 MeV, respectively.

² Assuming three-body phase-space decay to $K_S^0K^\pm\pi^\mp$.

NODE=M037G3;LINKAGE=AH
 NODE=M037G3;LINKAGE=B3

 $\eta(1295)$ BRANCHING RATIOS

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	BERTIN	97 OBLX	0.0 $\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp\pi^+\pi^-$
seen	BIRMAN	88 MPS	8 $\pi^-p \rightarrow K^+\bar{K}^0\pi^-n$
large	ANDO	86 SPEC	8 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
large	STANTON	79 CNTR	8.4 $\pi^-p \rightarrow n\eta 2\pi$

NODE=M037225

NODE=M037R1
 NODE=M037R1

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi^0\pi^0)$	Γ_2/Γ_4		
VALUE	DOCUMENT ID	TECN	COMMENT
0.65 ± 0.10	¹ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

NODE=M037R2
 NODE=M037R2

¹ Assuming that $a_0(980)$ decays only to $\eta\pi$.

NODE=M037R2;LINKAGE=A

$\Gamma(\eta(\pi\pi)_{S\text{-wave}})/\Gamma(\eta\pi^0\pi^0)$				Γ_5/Γ_4
VALUE	DOCUMENT ID	TECN	COMMENT	
0.35 ± 0.10	ALDE	97B	GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$

NODE=M037R4
 NODE=M037R4

$\Gamma(a_0(980)\pi)/\Gamma(\sigma\eta)$					Γ_2/Γ_6
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.48 ± 0.22	9082	MANAK	00A	MPS	$18\ \pi^-\ p \rightarrow \eta\ \pi^+\ \pi^-\ n$

NODE=M037R5
 NODE=M037R5

 $\eta(1295)$ REFERENCES

AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 60 458.		
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANTREASYAN	87	PR D36 2633	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP

NODE=M037

REFID=50764
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 REFID=45396

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 REFID=40568
 REFID=40008
 REFID=20891
 REFID=20887

$\pi(1300)$

$$I^G(J^{PC}) = 1^-(0^-+)$$

NODE=M058

 $\pi(1300)$ MASS

NODE=M058M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1300±100 OUR ESTIMATE

NODE=M058M

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

1128± 26±70		DARGENT	17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1345± 8±10	18k	¹ SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
1200± 40	90k	SALVINI	04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1343± 15±24		CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1375± 40		ABELE	01	CBAR	$0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
1275± 15		BERTIN	97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+ 2\pi^-$
~ 1114		ABELE	96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
1190± 30		ZIELINSKI	84	SPEC	$200 \pi^+ Z \rightarrow Z 3\pi$
1240± 30		BELLINI	82	SPEC	$40 \pi^- A \rightarrow A 3\pi$
1273± 50		² AARON	81	RVUE	
1342± 20		BONESINI	81	OMEG	$12 \pi^- p \rightarrow p 3\pi$
~ 1400		DAUM	81B	SPEC	$63,94 \pi^- p$

¹ From analysis of L3 data at 183–209 GeV.

² Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058M;LINKAGE=SC

NODE=M058M;LINKAGE=E

 $\pi(1300)$ WIDTH

NODE=M058W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

200 to 600 OUR ESTIMATE

NODE=M058W

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

314± 39±66		DARGENT	17	RVUE	$D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
260± 20±30	18k	³ SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
470±120	90k	SALVINI	04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
449± 39±47		CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
268± 50		ABELE	01	CBAR	$0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
218±100		BERTIN	97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+ 2\pi^-$
~ 340		ABELE	96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$
440± 80		ZIELINSKI	84	SPEC	$200 \pi^+ Z \rightarrow Z 3\pi$
360±120		BELLINI	82	SPEC	$40 \pi^- A \rightarrow A 3\pi$
580±100		⁴ AARON	81	RVUE	
220± 70		BONESINI	81	OMEG	$12 \pi^- p \rightarrow p 3\pi$
~ 600		DAUM	81B	SPEC	$63,94 \pi^- p$

³ From analysis of L3 data at 183–209 GeV.

⁴ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058W;LINKAGE=SC

NODE=M058W;LINKAGE=E

 $\pi(1300)$ DECAY MODES

NODE=M058215;NODE=M058

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \pi(\pi\pi)S\text{-wave}$	seen
$\Gamma_3 \quad \gamma\gamma$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

 $\pi(1300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M058218

 $\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_3/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.085 90 ACCIARRI 97T L3 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	95	⁵ SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$
<0.54	90	ALBRECHT	97B	ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

⁵ From analysis of L3 data at 183–209 GeV.

NODE=M058G1

NODE=M058G1

NODE=M058G1;LINKAGE=SC

$\pi(1300)$ BRANCHING RATIOS **$\Gamma(\pi\pi)_{S\text{-wave}}/\Gamma(\rho\pi)$**

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.2 $\pm$ 0.4		90k	SALVINI	04	OBLX $\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
seen			CHUNG	02	B852 $18.3 \pi^- p \rightarrow \pi^+ 2\pi^- p$
<0.15	90		ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$
2.12			⁶ AARON	81	RVUE

⁶ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from DAUM 80 and DANKOWYCH 81.

NODE=M058220

 NODE=M058R1
 NODE=M058R1

NODE=M058R1;LINKAGE=E

 $\pi(1300)$ REFERENCES

DARGENT	17	JHEP 1705 143	P. dArgent <i>et al.</i>	(HEID, BRIS)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ZIELINSKI	84	PR D30 1855	M. Zielinski <i>et al.</i>	(ROCH, MINN, FNAL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
AARON	81	PR D24 1207	R.A. Aaron, R.S. Longacre	(NEAS, BNL)
BONESINI	81	PL 103B 75	M. Bonesini <i>et al.</i>	(MILA, LIVP, DARE+)
DANKOWYCH...	81	PRL 46 580	J.A. Dankowycz <i>et al.</i>	(TNTO, BNL, CARL+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
DAUM	80	PL 89B 281	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BOWLER	75	NP B97 227	M.G. Bowler <i>et al.</i>	(OXFTP, DARE)

NODE=M058

 REFID=58121
 REFID=51186
 REFID=53226
 REFID=48837
 REFID=48334
 REFID=45761
 REFID=45418
 REFID=45763
 REFID=45011
 REFID=20881
 REFID=21134
 REFID=20870
 REFID=21130
 REFID=20572
 REFID=20872
 REFID=20868
 REFID=20571
 $a_2(1320)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

NODE=M012

 $a_2(1320)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1305–1321)–$i(52\text{--}58)$ OUR ESTIMATE			
(1318.7 $\pm$ 1.9 $\pm$ 1.3)– $i(53.8 \pm 2.3^{+1.7}_{-0.9})$	¹ KOPF	21	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$
(1312.5 $\pm$ 0.7 $\pm$ 2.6)– $i(53.5 \pm 0.6 \pm 1.9)$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
(1306.0 $\pm$ 0.8 $\pm$ 1.3)– $i(57.2 \pm 0.8 \pm 0.0)$	³ RODAS	19	RVUE 91 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
(1309 $\pm$ 4) – $i(55 \pm 2)$	⁴ ANISOVICH	09	RVUE $\bar{p}p, \pi N$

¹ Extraction based on a combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

² T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\bar{K}$).

³ Coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data. Supersedes JACKURA 18. Performed by JPAC.

⁴ Amplitude did not include dispersive corrections. From analysis of $\eta\pi$ mode.

NODE=M012PP

NODE=M012PP

NODE=M012PP

→ UNCHECKED ←

NODE=M012PP;LINKAGE=B

NODE=M012PP;LINKAGE=C

NODE=M012PP;LINKAGE=D

NODE=M012PP;LINKAGE=A

 $a_2(1320)$ MASS

VALUE (MeV)	DOCUMENT ID
1318.2 $\pm$ 0.6 OUR AVERAGE	Includes data from the 4 datablocks that follow this one. Error includes scale factor of 1.2.

NODE=M012M0

NODE=M012M0

3 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012M1
NODE=M012M1

1318.6 $\pm$ 1.3 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1314.5 $^{+4.0}_{-3.3}$	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1326 $\pm 2 \pm 2$		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1317 ± 3		BARBERIS	98B		450 $p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1323 $\pm 4 \pm 3$		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1320 ± 7		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$
1311.3 $\pm 1.6 \pm 3.0$	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1310 ± 5		ARMSTRONG	90	OMEG 0	300.0 $p p \rightarrow p p \pi^+ \pi^- \pi^0$
1323.8 ± 2.3	4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$
1320.6 ± 3.1	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$
1317 ± 2	25k	² DAUM	80C	SPEC $-$	63,94 $\pi^- p \rightarrow 3\pi p$
1320 ± 10	1097	² BALTAY	78B	HBC $+0$	15 $\pi^+ p \rightarrow p 4\pi$
1306 ± 8		FERRERSORIA	78	OMEG $-$	9 $\pi^- p \rightarrow p 3\pi$
1318 ± 7	1.6k	² EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$
1315 ± 5		² ANTIPOV	73C	CNTR $-$	25,40 $\pi^- p \rightarrow p \eta \pi^-$
1306 ± 9	1580	CHALOUKPA	73	HBC $-$	3.9 $\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1321 $\pm 1 \pm 0$	420k	³ ALEKSEEV	10	COMP	190 $\pi^- p b \rightarrow \pi^- \pi^- \pi^+ p b'$
1300 $\pm 2 \pm 4$	18k	⁴ SCHEGELSKY	06	RVUE 0	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$
1305 ± 14		CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$
1310 ± 2		² EVANGELIS...	81	OMEG $-$	12 $\pi^- p \rightarrow 3\pi p$
1343 ± 11	490	BALTAY	78B	HBC 0	15 $\pi^+ p \rightarrow \Delta 3\pi$
1309 ± 5	5k	BINNIE	71	MMS $-$	$\pi^- p$ near a_2 thresh- old
1299 ± 6	28k	BOWEN	71	MMS $-$	5 $\pi^- p$
1300 ± 6	24k	BOWEN	71	MMS $+$	5 $\pi^+ p$
1309 ± 4	17k	BOWEN	71	MMS $-$	7 $\pi^- p$
1306 ± 4	941	ALSTON...	70	HBC $+$	7.0 $\pi^+ p \rightarrow 3\pi p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

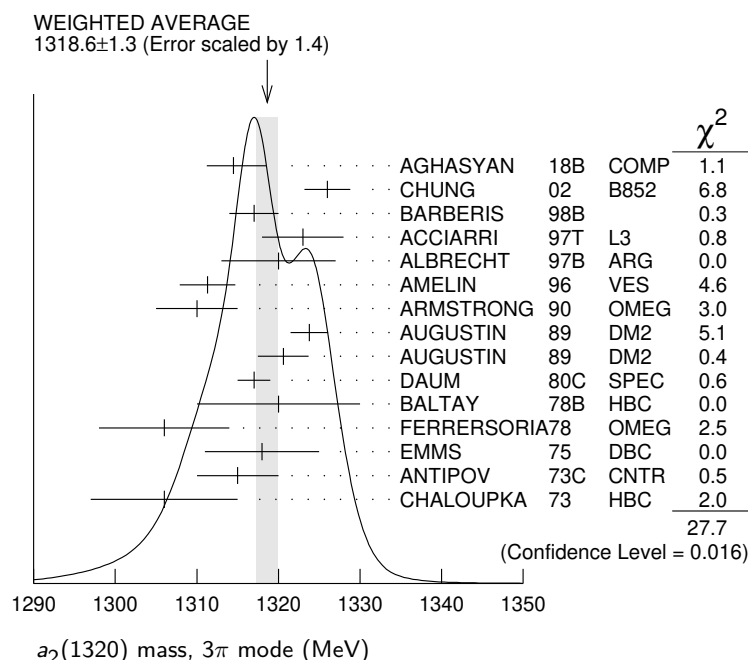
NODE=M012M1;LINKAGE=D
NODE=M012M1;LINKAGE=P
NODE=M012M1;LINKAGE=C
NODE=M012M1;LINKAGE=SC

¹ Statistical error negligible.

² From a fit to $J^P = 2^+ \rho \pi$ partial wave.

³ Superseded by AGHASYAN 2018B.

⁴ From analysis of L3 data at 183–209 GeV.



$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012M2
 NODE=M012M2

1318.1± 0.7 OUR AVERAGE

1319 ± 5	4700	^{1,2} CLELAND	82B	SPEC	+	50 $\pi^+ p \rightarrow K_S^0 K^+ p$
1324 ± 6	5200	^{1,2} CLELAND	82B	SPEC	-	50 $\pi^- p \rightarrow K_S^0 K^- p$
1320 ± 2	4000	CHABAUD	80	SPEC	-	17 $\pi^- A \rightarrow K_S^0 K^- A$
1312 ± 4	11000	CHABAUD	78	SPEC	-	9.8 $\pi^- p \rightarrow K^- K_S^0 p$
1316 ± 2	4730	CHABAUD	78	SPEC	-	18.8 $\pi^- p \rightarrow K^- K_S^0 p$
1318 ± 1		^{1,3} MARTIN	78D	SPEC	-	10 $\pi^- p \rightarrow K_S^0 K^- p$
1320 ± 2	2724	MARGULIE	76	SPEC	-	23 $\pi^- p \rightarrow K^- K_S^0 p$
1313 ± 4	730	FOLEY	72	CNTR	-	20.3 $\pi^- p \rightarrow K^- K_S^0 p$
1319 ± 3	1500	³ GRAYER	71	ASPK	-	17.2 $\pi^- p \rightarrow K^- K_S^0 p$

OCCUR=2

OCCUR=3

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1304 ± 10	870	⁴ SCHEGELSKY	06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1330 ± 11	1000	^{1,2} CLELAND	82B	SPEC	+	30 $\pi^+ p \rightarrow K_S^0 K^+ p$
1324 ± 5	350	HYAMS	78	ASPK	+	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$

¹ From a fit to $J^P = 2^+$ partial wave.² Number of events evaluated by us.³ Systematic error in mass scale subtracted.⁴ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012M2;LINKAGE=P
 NODE=M012M2;LINKAGE=W
 NODE=M012M2;LINKAGE=S
 NODE=M012M2;LINKAGE=SC

 $\eta\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012M3
 NODE=M012M3

1317.7± 1.4 OUR AVERAGE

1308 ± 9		BARBERIS	00H			450 $pp \rightarrow p_f \eta \pi^0 p_s$
1316 ± 9		BARBERIS	00H			450 $pp \rightarrow \Delta_f^{++} \eta \pi^- p_s$
1317 ± 1 ± 2		THOMPSON	97	MPS		18 $\pi^- p \rightarrow \eta \pi^- p$
1315 ± 5 ± 2		¹ AMSLER	94D	CBAR		0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
1325.1± 5.1		AOYAGI	93	BKEI		$\pi^- p \rightarrow \eta \pi^- p$
1317.7± 1.4± 2.0		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta \pi^- N$
1323 ± 8	1000	² KEY	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1307 ± 1 ± 6		³ JACKURA	18	RVUE		$\pi^- p \rightarrow \eta \pi^- p$
1315 ± 12		⁴ ADOLPH	15	COMP		191 $\pi^- p \rightarrow \eta^{(r)} \pi^- p$
1324 ± 5		ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1336.2± 1.7	2561	DELFOSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
1330.7± 2.4	1653	DELFOSE	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$
1324 ± 8	6200	^{2,5} CONFORTO	73	OSPK	-	6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

¹ The systematic error of 2 MeV corresponds to the spread of solutions.² Error includes 5 MeV systematic mass-scale error.³ Superseded by RODAS 19.⁴ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.⁵ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012M3;LINKAGE=DD
 NODE=M012M3;LINKAGE=E
 NODE=M012M3;LINKAGE=B
 NODE=M012M3;LINKAGE=A

NODE=M012M3;LINKAGE=M

 $\eta'\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012M4
 NODE=M012M4

1322 ± 7 OUR AVERAGE

1318 ± 8 $^{+3}_{-5}$		IVANOV	01	B852		18 $\pi^- p \rightarrow \eta' \pi^- p$
1327.0± 10.7		BELADIDZE	93	VES		37 $\pi^- N \rightarrow \eta' \pi^- N$

 $a_2(1320)$ WIDTH

NODE=M012W

VALUE (MeV)	DOCUMENT ID

107 ± 5 OUR ESTIMATE

NODE=M012W
 → UNCHECKED ←

107.8±1.2 OUR AVERAGE Includes data from the 4 datablocks that follow this one.

3 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W1
NODE=M012W1

105.0 $^{+1.7}_{-1.9}$ OUR AVERAGE

106.6 $^{+3.4}_{-7.0}$	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$	
108 $\pm 3 \pm 15$		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$	
120 ± 10		BARBERIS	98B		450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$	
105 $\pm 10 \pm 11$		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	
120 ± 10		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$	
103.0 $\pm 6.0 \pm 3.3$	72.4k	AMELIN	96	VES	36 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$	
120 ± 10		ARMSTRONG	90	OMEG 0	300.0 $pp \rightarrow pp \pi^+ \pi^- \pi^0$	
107.0 ± 9.7	4022	AUGUSTIN	89	DM2 $\pm$	$J/\psi \rightarrow \rho^\pm a_2^\mp$	
118.5 ± 12.5	3562	AUGUSTIN	89	DM2 0	$J/\psi \rightarrow \rho^0 a_2^0$	OCCUR=2
97 ± 5		² EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow 3\pi p$	
96 ± 9	25k	² DAUM	80C	SPEC -	63,94 $\pi^- p \rightarrow 3\pi p$	
110 ± 15	1097	² BALTAY	78B	HBC +0	15 $\pi^+ p \rightarrow p 4\pi$	
112 ± 18	1.6k	² EMMS	75	DBC 0	4 $\pi^+ n \rightarrow p(3\pi)^0$	
122 ± 14	1.2k	^{2,3} WAGNER	75	HBC 0	7 $\pi^+ p \rightarrow \Delta^{++}(3\pi)^0$	
115 ± 15		² ANTIPOV	73C	CNTR -	25,40 $\pi^- p \rightarrow p \eta \pi^-$	
99 ± 15	1580	CHALOUPKA	73	HBC -	3.9 $\pi^- p$	
105 ± 5	28k	BOWEN	71	MMS -	5 $\pi^- p$	
99 ± 5	24k	BOWEN	71	MMS +	5 $\pi^+ p$	OCCUR=2
103 ± 5	17k	BOWEN	71	MMS -	7 $\pi^- p$	OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

110 $\pm 2 \pm 15$	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$	
117 $\pm 6 \pm 20$	18k	⁵ SCHEGELSKY	06	RVUE 0	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	
120 ± 40		CONDO	93	SHF	$\gamma p \rightarrow n \pi^+ \pi^+ \pi^-$	
115 ± 14	490	BALTAY	78B	HBC 0	15 $\pi^+ p \rightarrow \Delta 3\pi$	OCCUR=2
72 ± 16	5k	BINNIE	71	MMS -	$\pi^- p$ near a_2 thresh- old	OCCUR=2
79 ± 12	941	ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$	

¹ Statistical error negligible.

² From a fit to $J^P = 2^+ \rho\pi$ partial wave.

³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁴ Superseded by AGHASYAN 2018B.

⁵ From analysis of L3 data at 183–209 GeV.

NODE=M012W1;LINKAGE=C
NODE=M012W1;LINKAGE=P
NODE=M012W1;LINKAGE=S
NODE=M012W1;LINKAGE=E
NODE=M012W1;LINKAGE=SC

K $\bar{K}$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W2
NODE=M012W2

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{1,2} CLELAND	82B	SPEC +	50 $\pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
120 ± 25	5200	^{1,2} CLELAND	82B	SPEC -	50 $\pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
106 ± 4	4000	CHABAUD	80	SPEC -	17 $\pi^- A \rightarrow K_S^0 K^- A$	
126 ± 11	11000	CHABAUD	78	SPEC -	9.8 $\pi^- p \rightarrow K^- K_S^0 p$	
101 ± 8	4730	CHABAUD	78	SPEC -	18.8 $\pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
113 ± 4		^{1,3} MARTIN	78D	SPEC -	10 $\pi^- p \rightarrow K_S^0 K^- p$	
105 ± 8	2724	³ MARGULIE	76	SPEC -	23 $\pi^- p \rightarrow K^- K_S^0 p$	
113 ± 19	730	FOLEY	72	CNTR -	20.3 $\pi^- p \rightarrow K^- K_S^0 p$	
123 ± 13	1500	³ GRAYER	71	ASPK -	17.2 $\pi^- p \rightarrow K^- K_S^0 p$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
120 ± 15	870	⁴ SCHEGELSKY	06A	RVUE 0	$\gamma\gamma \rightarrow K_S^0 K_S^0$	
121 ± 51	1000	^{1,2} CLELAND	82B	SPEC +	30 $\pi^+ p \rightarrow K_S^0 K^+ p$	
110 ± 18	350	HYAMS	78	ASPK +	12.7 $\pi^+ p \rightarrow K^+ K_S^0 p$	

- ¹ From a fit to $J^P = 2^+$ partial wave.
² Number of events evaluated by us.
³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
⁴ From analysis of L3 data at 91 and 183–209 GeV.

NODE=M012W2;LINKAGE=P
 NODE=M012W2;LINKAGE=W
 NODE=M012W2;LINKAGE=S
 NODE=M012W2;LINKAGE=SC

$\eta\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W3
 NODE=M012W3

111.1 ± 2.4 OUR AVERAGE

115 ± 20		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$
112 ± 14		BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
112 ± 3 ± 2		¹ AMSLER	94D	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 ± 6 ± 3		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta \pi^- N$
112.2 ± 5.7	2561	DELFOSE	81	SPEC +	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 ± 7.7	1653	DELFOSE	81	SPEC -	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108 ± 9	1000	KEY	73	OSPK -	6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

112 ± 1 ± 8		² JACKURA	18	RVUE	$\pi^- p \rightarrow \eta \pi^- p$
119 ± 14		³ ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(I)} \pi^- p$
127 ± 2 ± 2		⁴ THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
118 ± 10		ARMSTRONG	93C	E760 0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104 ± 9	6200	⁵ CONFORTO	73	OSPK -	6 $\pi^- p \rightarrow p \pi^- \eta$

¹ The systematic error of 2 MeV corresponds to the spread of solutions.

² Superseded by RODAS 19.

³ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.

⁴ Resolution is not unfolded.

⁵ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=DD
 NODE=M012W3;LINKAGE=C
 NODE=M012W3;LINKAGE=B

NODE=M012W3;LINKAGE=A
 NODE=M012W3;LINKAGE=M

$\eta'\pi$ MODE

VALUE (MeV) DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M012W4
 NODE=M012W4

119 ± 25 OUR AVERAGE

140 ± 35 ± 20		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
106 ± 32		BELADIDZE	93	VES	37 $\pi^- N \rightarrow \eta' \pi^- N$

$a_2(1320)$ DECAY MODES

NODE=M012215;NODE=M012

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 3π	(70.1 ± 2.7) %	S=1.2
Γ_2 $\rho(770)\pi$		
Γ_3 $f_2(1270)\pi$		
Γ_4 $\rho(1450)\pi$		
Γ_5 $\eta\pi$	(14.5 ± 1.2) %	
Γ_6 $\omega\pi\pi$	(10.6 ± 3.2) %	S=1.3
Γ_7 $K\bar{K}$	(4.9 ± 0.8) %	
Γ_8 $\eta'(958)\pi$	(5.5 ± 0.9) × 10 ⁻³	
Γ_9 $\pi^\pm\gamma$	(2.91 ± 0.27) × 10 ⁻³	
Γ_{10} $\gamma\gamma$	(9.4 ± 0.7) × 10 ⁻⁶	
Γ_{11} e^+e^-	< 5 × 10 ⁻⁹	CL=90%

DESIG=1
 DESIG=11
 DESIG=12
 DESIG=13
 DESIG=3
 DESIG=4
 DESIG=2
 DESIG=8
 DESIG=7
 DESIG=9
 DESIG=10

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 18 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 9.3$ for 15 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	10		
x_6	-89	-46	
x_7	-1	-2	-24
	x_1	x_5	x_6

$a_2(1320)$ PARTIAL WIDTHS

$\Gamma(\eta\pi)$

Γ_5

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

18.5 ± 3.0	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012220

NODE=M012W6
NODE=M012W6

NODE=M012W6;LINKAGE=SC

$\Gamma(K\bar{K})$

Γ_7

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.0^{+2.0}_{-1.5}$	870	¹ SCHEGELSKY 06A	RVUE	0	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(a_2(1320) \rightarrow \gamma\gamma) = 0.91$ keV and SU(3) relations.

NODE=M012W5
NODE=M012W5

NODE=M012W5;LINKAGE=SC

$\Gamma(\pi^\pm\gamma)$

Γ_9

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

311 ± 25 OUR AVERAGE

$358 \pm 6 \pm 42$		¹ ADOLPH	14	COMP	– 190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$

$284 \pm 25 \pm 25$	7.1k	MOLCHANOV 01	SELX		600 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

295 ± 60		CIHANGIR 82	SPEC	+	200 $\pi^+ A$

• • • We do not use the following data for averages, fits, limits, etc. • • •

461 ± 110		² MAY	77	SPEC	± 9.7 γA

¹ Primakoff reaction using $a_2(1320) \rightarrow 3\pi$ branching ratio of 70.1%.

² Assuming one-pion exchange.

NODE=M012W7
NODE=M012W7

NODE=M012W7;LINKAGE=AD
NODE=M012W;LINKAGE=M2

$\Gamma(\gamma\gamma)$

Γ_{10}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1.00 ± 0.06 OUR AVERAGE

$0.98 \pm 0.05 \pm 0.09$		ACCIARRI	97T	L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

$0.96 \pm 0.03 \pm 0.13$		ALBRECHT	97B	ARG	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

$1.26 \pm 0.26 \pm 0.18$	36	BARU	90	MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

$1.00 \pm 0.07 \pm 0.15$	415	BEHREND	90C	CELL	0 $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

$1.03 \pm 0.13 \pm 0.21$		BUTLER	90	MRK2	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \pi^0$

$1.01 \pm 0.14 \pm 0.22$	85	OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

$0.90 \pm 0.27 \pm 0.15$	56	¹ ALTHOFF	86	TASS	0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

$1.14 \pm 0.20 \pm 0.26$		² ANTREASYAN	86	CBAL	0 $e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

$1.06 \pm 0.18 \pm 0.19$		BERGER	84C	PLUT	0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.81 \pm 0.19^{+0.42}_{-0.11}$	35	¹ BEHREND	82C	CELL	0 $e^+ e^- \rightarrow e^+ e^- 3\pi$

$0.77 \pm 0.18 \pm 0.27$	22	² EDWARDS	82F	CBAL	0 $e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$

¹ From $\rho\pi$ decay mode.

² From $\eta\pi^0$ decay mode.

NODE=M012W9
NODE=M012W9

NODE=M012W;LINKAGE=F
NODE=M012W;LINKAGE=G

$\Gamma(e^+e^-)$ Γ_{11}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.56	90	ACHASOV	00K SND	$e^+e^- \rightarrow \pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<25	90	VOROBYEV	88 ND	$e^+e^- \rightarrow \pi^0\eta$

NODE=M012W10
 NODE=M012W10

 $a_2(1320) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M012223

 $\Gamma(3\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{10}/\Gamma$

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.65±0.02±0.02	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

NODE=M012G2
 NODE=M012G2

¹ From analysis of L3 data at 183–209 GeV.

NODE=M012G2;LINKAGE=SC

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_5\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.145 ^{+0.097} _{-0.034}	¹ UEHARA 09A BELL		$e^+e^- \rightarrow e^+e^-\eta\pi^0$

NODE=M012G01
 NODE=M012G01

¹ From the D_2 -wave. The fraction of the D_0 -wave is 3.4^{+2.3}_{-1.1}%.

NODE=M012G01;LINKAGE=UE

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{10}/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.126±0.007±0.028	¹ ALBRECHT 90G ARG		$e^+e^- \rightarrow e^+e^-K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.081±0.006±0.027	² ALBRECHT 90G ARG		$e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M012G1
 NODE=M012G1

¹ Using an incoherent background.² Using a coherent background.

OCCUR=2

NODE=M012G1;LINKAGE=A
 NODE=M012G1;LINKAGE=B

 $a_2(1320) \text{ BRANCHING RATIOS}$

NODE=M012225

 $[\Gamma(f_2(1270)\pi) + \Gamma(\rho(1450)\pi)]/\Gamma(\rho(770)\pi)$ $(\Gamma_3+\Gamma_4)/\Gamma_2$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.12	90	ABRAMOVI...	70B HBC	—	3.93 π^-p

NODE=M012R9
 NODE=M012R9

 $\Gamma(\rho(770)\pi)/\Gamma(f_2(1270)\pi)$ Γ_2/Γ_3

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
16.5^{+1.2}_{-2.4}	46M	¹ AGHASYAN 18B COMP	190 $\pi^-p \rightarrow \pi^- \pi^+ \pi^- p$	

NODE=M012R00
 NODE=M012R00

¹ Statistical error negligible.

NODE=M012R00;LINKAGE=A

 $\Gamma(\eta\pi)/\Gamma(3\pi)$ Γ_5/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
0.207±0.018 OUR FIT					
0.213±0.020 OUR AVERAGE					
0.18 ±0.05		FORINO 76	HBC		11 π^-p
0.22 ±0.05	52	ANTIPOV 73	CNTR	—	40 π^-p
0.211±0.044	149	CHALOUPKA 73	HBC	—	3.9 π^-p
0.246±0.042	167	ALSTON-... 71	HBC	+	7.0 π^+p
0.25 ±0.09	15	BOECKMANN 70	HBC	+	5.0 π^+p
0.23 ±0.08	22	ASCOLI 68	HBC	—	5 π^-p
0.12 ±0.08		CHUNG 68	HBC	—	3.2 π^-p
0.22 ±0.09		CONTE 67	HBC	—	11.0 π^-p

NODE=M012R3
 NODE=M012R3

 $\Gamma(\omega\pi\pi)/\Gamma(3\pi)$ Γ_6/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
0.15±0.05 OUR FIT	Error includes scale factor of 1.3.				
0.15±0.05 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
0.28±0.09	60	DIAZ 74	DBC	0	6 π^+n
0.18±0.08		¹ KARSHON 74	HBC		Avg. of above two
0.10±0.05	279	² CHALOUPKA 73	HBC	—	3.9 π^-p
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.29±0.08	140	¹ KARSHON 74	HBC	0	4.9 π^+p
0.10±0.04	60	¹ KARSHON 74	HBC	+	4.9 π^+p
0.19±0.08		DEFOIX 73	HBC	0	0.7 $\bar{p}p$

NODE=M012R12
 NODE=M012R12

OCCUR=3

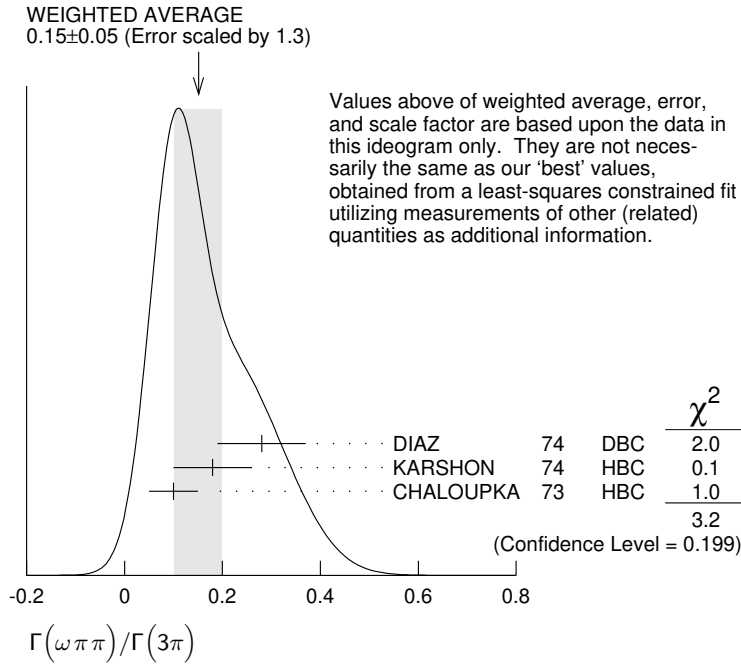
OCCUR=2

¹KARSHON 74 suggest an additional $I = 0$ state strongly coupled to $\omega\pi\pi$ which could explain discrepancies in branching ratios and masses. We use a central value and a systematic spread.

²Decays to $b_1(1040)\pi$, $b_1 \rightarrow \omega\pi$. Error increased to account for possible systematic errors of complicated analysis.

NODE=M012R12;LINKAGE=K

NODE=M012R12;LINKAGE=01

 $\Gamma(K\bar{K})/\Gamma(3\pi)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.070±0.012 OUR FIT					
0.078±0.017		CHABAUD 78	RVUE		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.011±0.003		¹ BERTIN 98B	OBLX		0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$
0.056±0.014	50	² CHALOUPKA 73	HBC	—	3.9 $\pi^- p$
0.097±0.018	113	² ALSTON-... 71	HBC	+	7.0 $\pi^+ p$
0.06 ±0.03		² ABRAMOV... 70B	HBC	—	3.93 $\pi^- p$
0.054±0.022		² CHUNG 68	HBC	—	3.2 $\pi^- p$

¹Using 4 π data from BERTIN 97D.

²Included in CHABAUD 78 review.

NODE=M012R1
NODE=M012R1NODE=M012R1;LINKAGE=BE
NODE=M012R1;LINKAGE=C $\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_7/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.31 ±0.22 ^{+0.09} / _{-0.11}	¹ KOPF 21	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$
0.352±0.011±0.175	² ALBRECHT 20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
0.08 ±0.02	³ BERTIN 98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_s^\mp \pi^\mp$

¹From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

²Residues from T-matrix pole with 2 poles, 2 channels ($\pi^0\eta$ and $K\bar{K}$).

³Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R14
NODE=M012R14

NODE=M012R14;LINKAGE=B

NODE=M012R14;LINKAGE=A
NODE=M012R14;LINKAGE=BE $\Gamma(\eta\pi)/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$ $\Gamma_5/(\Gamma_1+\Gamma_5+\Gamma_7)$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
0.162±0.012 OUR FIT					
0.140±0.028 OUR AVERAGE					
0.13 ±0.04		ESPIGAT 72	HBC	±	0.0 $\bar{p}p$
0.15 ±0.04	34	BARNHAM 71	HBC	+	3.7 $\pi^+ p$

NODE=M012R2
NODE=M012R2

$$\Gamma(K\bar{K})/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$$

$$\Gamma_7/(\Gamma_1 + \Gamma_5 + \Gamma_7)$$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
0.054±0.009 OUR FIT						
0.048±0.012 OUR AVERAGE						
0.05 ±0.02		TOET	73	HBC	+	5 $\pi^+ p$
0.09 ±0.04		TOET	73	HBC	0	5 $\pi^+ p$
0.03 ±0.02	8	¹ DAMERI	72	HBC	−	11 $\pi^- p$
0.06 ±0.03	17	BARNHAM	71	HBC	+	3.7 $\pi^+ p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
0.020±0.004		² ESPIGAT	72	HBC	±	0.0 $\bar{p} p$

¹ Montanet agrees. Vlada.

² Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8
NODE=M012R8

OCCUR=2

NODE=M012R8;LINKAGE=01
NODE=M012R8;LINKAGE=A

$$\Gamma(\eta'(958)\pi)/\Gamma_{\text{total}}$$

$$\Gamma_8/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<0.006	95	ALDE	92B	GAM2	38,100 $\pi^- p \rightarrow \eta' \pi^0 n$
<0.02	97	BARNHAM	71	HBC	+ 3.7 $\pi^+ p$
0.004±0.004		¹ BOESEBECK	68	HBC	+ 8 $\pi^+ p$

¹ No longer valid since $\Gamma(K\bar{K})/\Gamma(3\pi)$ value has changed (MORRISON 71).

NODE=M012R4
NODE=M012R4

NODE=M012R4;LINKAGE=B

$$\Gamma(\eta'(958)\pi)/\Gamma(3\pi)$$

$$\Gamma_8/\Gamma_1$$

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<0.011	90	EISENSTEIN	73	HBC	−	5 $\pi^- p$
<0.04		ALSTON-...	71	HBC	+	7.0 $\pi^+ p$
0.04 $\begin{smallmatrix} +0.03 \\ -0.04 \end{smallmatrix}$		BOECKMANN	70	HBC	0	5.0 $\pi^+ p$

NODE=M012R5
NODE=M012R5

$$\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$$

$$\Gamma_8/\Gamma_5$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.038±0.005 OUR AVERAGE			
0.05 ±0.02	ADOLPH	15	COMP 191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
0.032±0.009	ABELE	97C	CBAR 0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta'$
0.047±0.010±0.004	¹ BELADIDZE	93	VES 37 $\pi^- N \rightarrow a_2^- N$
0.034±0.008±0.005	BELADIDZE	92	VES 36 $\pi^- C \rightarrow a_2^- C$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.046±0.015 $\begin{smallmatrix} +0.07 \\ -0.006 \end{smallmatrix}$	² KOPF	21	RVUE 0.9 $p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta\eta, \pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$

¹ Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 0.236$.

² From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\bar{K}$ systems.

NODE=M012R13
NODE=M012R13

OCCUR=2

NODE=M012R13;LINKAGE=A

NODE=M012R13;LINKAGE=C

$$\Gamma(\pi^\pm \gamma)/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.005 $\begin{smallmatrix} +0.005 \\ -0.003 \end{smallmatrix}$	¹ EISENBERG	72	HBC 4.3,5.25,7.5 γp

¹ Pion-exchange model used in this estimation.

NODE=M012R11
NODE=M012R11

NODE=M012R11;LINKAGE=R

$$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{11}/\Gamma$$

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<6	90	ACHASOV	00K	SND $e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M012R15
NODE=M012R15

a₂(1320) REFERENCES

NODE=M012

KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)	REFID=61470
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=59554
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59471
JACKURA	18	PL B779 464	A. Jackura <i>et al.</i>	(JPAC and COMPASS Collab.)	REFID=59003
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=56385
ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)	REFID=55911
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)	REFID=53356
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		REFID=51186
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)	REFID=48317
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)	REFID=48559
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47933
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46345
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45531
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=45761
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=45418
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)	REFID=45584
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)	REFID=44649
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)	REFID=43599
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43598
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=43600
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41852
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42171
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)	REFID=41375
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)	REFID=41366
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=41356
BUTLER	90	PR D42 1368	F. Butler <i>et al.</i>	(Mark II Collab.)	REFID=41363
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
ALTHOFF	86	Translated from YAF 48 436	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21287
ANTREASYAN	86	ZPHY C31 537	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=20469
BERGER	84C	PR D33 1847	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=21286
BEHREND	82C	PL 149B 427	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20303
Also		PL 125B 518 (errat.)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
CHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
DELFOSSSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B175 189	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	PL 89B 276	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21275
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
CHABAUD	78	NP B145 349	V. Chabaud <i>et al.</i>	(CERN, MPIM)	REFID=21267
FERRERSORIA	78	PL 74B 287	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)	REFID=21270
HYAMS	78	NP B146 303	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)	REFID=21271
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA) JP	REFID=21272
MAY	77	PR D16 1983	E.N. May <i>et al.</i>	(ROCH, CORN)	REFID=20450
FORINO	76	NC 35A 465	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)	REFID=21259
MARGULIE	76	PR D14 667	M. Margulies <i>et al.</i>	(BNL, CUNY)	REFID=21261
EMMS	75	PL 58B 117	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL) JP	REFID=21254
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP	REFID=20843
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)	REFID=21248
KARSHON	74	PRL 32 852	U. Karshon <i>et al.</i>	(REHO)	REFID=21249
ANTIPOV	73	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=21238
ANTIPOV	73C	NP B63 153	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=20817
CHALOUPKA	73	PL 44B 211	V. Chaloupka <i>et al.</i>	(CERN)	REFID=21242
CONFORTO	73	PL 45B 154	G. Conforto <i>et al.</i>	(EFI, FNAL, TNTO+)	REFID=21243
DEFOIX	73	PL 43B 141	C. Defoix <i>et al.</i>	(CDEF)	REFID=21244
EISENSTEIN	73	PR D7 278	L. Eisenstein <i>et al.</i>	(ILL)	REFID=21245
KEY	73	PRL 30 503	A.W. Key <i>et al.</i>	(TNTO, EFI, FNAL, WISC)	REFID=21246
TOET	73	NP B63 248	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)	REFID=20714
DAMERI	72	NC 9A 1	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)	REFID=20338
EISENBERG	72	PR D5 15	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)	REFID=20098
ESPIGAT	72	NP B36 93	P. Espigat <i>et al.</i>	(CERN, CDEF)	REFID=21232
FOLEY	72	PR D6 747	K.J. Foley <i>et al.</i>	(BNL, CUNY)	REFID=21233
ALSTON...	71	PL 34B 156	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21214
BARNHAM	71	PRL 26 1494	K.W.J. Barnham <i>et al.</i>	(LBL)	REFID=21215
BINNIE	71	PL 36B 257	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=21217
BOWEN	71	PRL 26 1663	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21219
GRAYER	71	PL 34B 333	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=21223
ABRAMOVI...	70B	NP B23 466	M. Abramovich <i>et al.</i>	(CERN) JP	REFID=21195
ALSTON...	70	PL 33B 607	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21196
BOECKMANN	70	NP B16 221	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)	REFID=21202
ASCOLI	68	PRL 20 1321	G. Ascoli <i>et al.</i>	(ILL) JP	REFID=21171
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CONTE	67	NC 51A 175	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=21166

$f_0(1370)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances" and a note on "Non- $q\bar{q}$ Candidates" in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M147

NODE=M147

 $f_0(1370)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M147PP

NODE=M147PP

NODE=M147PP

→ UNCHECKED ←

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M147PP;LINKAGE=G
NODE=M147PP;LINKAGE=I
NODE=M147PP;LINKAGE=E

NODE=M147PP;LINKAGE=AO
NODE=M147PP;LINKAGE=BG
NODE=M147PP;LINKAGE=PC
NODE=M147PP;LINKAGE=TK
NODE=M147PP;LINKAGE=K
NODE=M147PP;LINKAGE=A

NODE=M147PP;LINKAGE=C
NODE=M147PP;LINKAGE=DD

NODE=M147PP;LINKAGE=BB

NODE=M147PP;LINKAGE=C1
NODE=M147PP;LINKAGE=KM
NODE=M147PP;LINKAGE=H

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1250–1440) –i (60–300) OUR ESTIMATE			
$(1245 \pm 40) - i(300^{+30}_{-70})$	¹ PELAEZ	23	RVUE Compilation
$(1380^{+70}_{-60}) - i(220^{+80}_{-70})$	² PELAEZ	23	RVUE Compilation
$(1370 \pm 40) - i(195 \pm 20)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1280.6 \pm 1.6 \pm 47.4) - i(205.2 \pm 1.7 \pm 20.7)$	³ ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
$(1290 \pm 50) - i(170^{+20}_{-40})$	⁴ ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1373 \pm 15) - i(137 \pm 10)$	⁵ BARGIOTTI	03	OBLX $\bar{p}p$
$(1302 \pm 17) - i(166 \pm 18)$	⁶ BARBERIS	00C	450 $pp \rightarrow pf 4\pi p_s$
$(1312 \pm 25 \pm 10) - i(109 \pm 22 \pm 15)$	BARBERIS	99D	OMEG $450 \bar{p}p \rightarrow K^+K^-, \pi^+\pi^-$
$(1406 \pm 19) - i(80 \pm 6)$	⁷ KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$(1300 \pm 20) - i(120 \pm 20)$	ANISOVICH	98B	RVUE Compilation
$(1290 \pm 15) - i(145 \pm 15)$	BARBERIS	97B	OMEG $450 \bar{p}p \rightarrow pp2(\pi^+\pi^-)$
$(1548 \pm 40) - i(560 \pm 40)$	BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
$(1380 \pm 40) - i(180 \pm 25)$	ABELE	96B	CBAR $0.0 \bar{p}p \rightarrow \pi^0K_L^0K_L^0$
$(1300 \pm 15) - i(115 \pm 8)$	BUGG	96	RVUE
$(1330 \pm 50) - i(150 \pm 40)$	⁸ AMSLER	95B	CBAR $\bar{p}p \rightarrow 3\pi^0$
$(1360 \pm 35) - i(150-300)$	⁸ AMSLER	95C	CBAR $\bar{p}p \rightarrow \pi^0\eta\eta$
$(1390 \pm 30) - i(190 \pm 40)$	⁹ AMSLER	95D	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$
1346 – i249	^{10,11} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1214 – i168	^{11,12} TORNQVIST	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1364 – i139	AMSLER	94D	CBAR $\bar{p}p \rightarrow \pi^0\pi^0\eta$
$(1365^{+20}_{-55}) - i(134 \pm 35)$	ANISOVICH	94	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$
$(1340 \pm 40) - i(127^{+30}_{-20})$	¹³ BUGG	94	RVUE $\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$
$(1430 \pm 5) - i(73 \pm 13)$	¹⁴ KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
1420 – i220	¹⁵ AU	87	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

¹ From forward dispersion relation applied to $\pi\pi$ scattering data.

² From partial-wave dispersion relation applied to $\pi\pi \rightarrow \bar{K}K$ data.

³ T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).

⁴ Another pole is found at $(1510 \pm 130) - i(800^{+100}_{-150})$ MeV.

⁵ Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0\pi^\mp$.

⁶ Average between $\pi^+\pi^-\pi^0$ and $2(\pi^+\pi^-)$.

⁷ T-matrix pole on sheet – – –.

⁸ Supersedes ANISOVICH 94.

⁹ Coupled-channel analysis of $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$, and $\pi^0\pi^0\eta$ on sheet IV. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

¹⁰ Analysis of data from FALVARD 88.

¹¹ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

¹² Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

¹³ Reanalysis of ANISOVICH 94 data.

¹⁴ T-matrix pole on sheet III.

¹⁵ Analysis of data from OCHS 73, GRAYER 74, BECKER 79, and CASON 83.

$f_0(1370)$ BREIT-WIGNER MASS

VALUE (MeV)

DOCUMENT ID

1200 to 1500 OUR ESTIMATE

NODE=M147205

NODE=M147M

→ UNCHECKED ←

NODE=M147M1

NODE=M147M1

 $\pi\pi$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1400±40		¹ AUBERT 09L	BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
1470 ⁺⁶ ₋₇ ⁺⁷² ₋₂₅₅		² UEHARA 08A	BELL	10.6 $e^+e^- \rightarrow \pi^0 \pi^0$ $e^+e^- \rightarrow \pi^0 \pi^0$
1259±55	2.6k	BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
1309±1±15		³ BUGG 07A	RVUE	0.0 $p\bar{p} \rightarrow 3\pi^0$
1449±13	4.3k	⁴ GARMASH 06	BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
1350±50		ABLIKIM 05	BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
1265±30 ⁺²⁰ ₋₃₅		ABLIKIM 05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1434±18±9	848	AITALA 01A	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
1308±10		BARBERIS 99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
1315±50		BELLAZZINI 99	GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
1315±30		ALDE 98	GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
1280±55		BERTIN 98	OBLX	0.05-0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1186		^{5,6} TORNQVIST 95	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1472±12		ARMSTRONG 91	OMEG	300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$
1275±20		BREAKSTONE 90	SFM	62 $pp \rightarrow pp\pi^+ \pi^-$
1420±20		AKESSON 86	SPEC	63 $pp \rightarrow pp\pi^+ \pi^-$
1256		FROGGATT 77	RVUE	$\pi^+ \pi^-$ channel

¹ Breit-Wigner mass.² Breit-Wigner mass. May also be the $f_0(1500)$.³ Reanalysis of ABELE 96C data.⁴ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.⁵ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CA-SON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.⁶ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

NODE=M147M1;LINKAGE=BW

NODE=M147M1;LINKAGE=UE

NODE=M147M1;LINKAGE=BU

NODE=M147M1;LINKAGE=GR

NODE=M147M1;LINKAGE=BB

NODE=M147M1;LINKAGE=FF

 $K\bar{K}$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1422±15±28		¹ AAIJ 19H	LHCB	$pp \rightarrow D^\pm X$
1360±31±28	430	^{2,3} DOBBS 15		$J/\psi \rightarrow \gamma K^+ K^-$
1350±48±15	168	^{2,3} DOBBS 15		$\psi(2S) \rightarrow \gamma K^+ K^-$
1440±6		VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1391±10		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1440±50		BOLONKIN 88	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1463±9		ETKIN 82B	MPS	23 $\pi^- p \rightarrow n 2K_S^0$
1425±15		WICKLUND 80	SPEC	6 $\pi N \rightarrow K^+ K^- N$
~1300		POLYCHRO... 79	STRC	7 $\pi^- p \rightarrow n 2K_S^0$

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the isobar model A.² Using CLEO-c data but not authored by the CLEO Collaboration.³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 346$ MeV.

NODE=M147M2;LINKAGE=F

NODE=M147M2;LINKAGE=A

NODE=M147M2;LINKAGE=B

 4π MODE $2(\pi\pi)_S + pp$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1395±40		ABELE 01	CBAR	0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
1374±38		AMSLER 94	CBAR	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
1345±12		ADAMO 93	OBLX	$\bar{n}p \rightarrow 3\pi^+ 2\pi^-$
1386±30		GASPERO 93	DBC	0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$
~1410	5751	¹ BETTINI 66	DBC	0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$

¹ $\rho\rho$ dominant.

NODE=M147M3

NODE=M147M3

NODE=M147M3;LINKAGE=BE

$\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$1262^{+51+82}_{-78-103}$	¹ UEHARA	10A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$
1430	AMSLER	92 CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \eta\eta$
1220 ± 40	ALDE	86D GAM4	$100 \pi^- p \rightarrow n 2\eta$

¹ Breit-Wigner mass. May also be the $f_0(1500)$.

NODE=M147M4
NODE=M147M4

NODE=M147M4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$1330.2^{+5.9}_{-6.5} \pm 5.1$	¹ AAIJ	19H LHCB	$pp \rightarrow D^\pm X$
1306 ± 20	² ANISOVICH	03 RVUE	

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUDE 18.

² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta\eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.

NODE=M147M5
NODE=M147M5

NODE=M147M5;LINKAGE=A

NODE=M147M;LINKAGE=KM

 $f_0(1370)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID
200 to 500 OUR ESTIMATE	

NODE=M147210

NODE=M147W
→ UNCHECKED ←

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
300 ± 80		¹ AUBERT	09L BABR	$B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
90^{+2+50}_{-1-22}		² UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
298 ± 21	2.6k	BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
126 ± 25	4286	³ GARMASH	06 BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
265 ± 40		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$350 \pm 100^{+105}_{-60}$		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
$173 \pm 32 \pm 6$	848	AITALA	01A E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
222 ± 20		BARBERIS	99B OMEG	$450 pp \rightarrow p_S p_f \pi^+ \pi^-$
255 ± 60		BELLAZZINI	99 GAM4	$450 pp \rightarrow pp \pi^0 \pi^0$
190 ± 50		ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
323 ± 13		BERTIN	98 OBLX	$0.05-0.405 \bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
350		^{4,5} TORNQVIST	95 RVUE	$\pi\pi \rightarrow \pi\pi, K \bar{K}, K\pi, \eta\pi$
195 ± 33		ARMSTRONG	91 OMEG	$300 pp \rightarrow pp \pi\pi, pp K \bar{K}$
285 ± 60		BREAKSTONE	90 SFM	$62 pp \rightarrow pp \pi^+ \pi^-$
460 ± 50		AKESSON	86 SPEC	$63 pp \rightarrow pp \pi^+ \pi^-$
~ 400		⁶ FROGGATT	77 RVUE	$\pi^+ \pi^-$ channel

¹ The systematic errors are not reported.

² Breit-Wigner width. May also be the $f_0(1500)$.

³ Also observed by GARMASH 07 in $B^0 \rightarrow K_S^0 \pi^+ \pi^-$ decays. Supersedes GARMASH 05.

⁴ Uses data from BEIER 72B, OCHS 73, HYAMS 73, GRAYER 74, ROSSELET 77, CASON 83, ASTON 88, and ARMSTRONG 91B. Coupled channel analysis with flavor symmetry and all light two-pseudoscalars systems.

⁵ Also observed by ASNER 00 in $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decays

⁶ Width defined as distance between 45 and 135° phase shift.

NODE=M147W1
NODE=M147W1

NODE=M147W1;LINKAGE=NS
NODE=M147W1;LINKAGE=UE
NODE=M147W1;LINKAGE=GR
NODE=M147W1;LINKAGE=BB

NODE=M147W1;LINKAGE=FF
NODE=M147W1;LINKAGE=E

 $K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$324 \pm 38 \pm 42$	¹ AAIJ	19H LHCB	$pp \rightarrow D^\pm X$
121 ± 15	VLADIMIRSK...	06 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
55 ± 26	TIKHOMIROV	03 SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
250 ± 80	BOLONKIN	88 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
118^{+138}_{-16}	ETKIN	82B MPS	$23 \pi^- p \rightarrow n 2K_S^0$
160 ± 30	WICKLUND	80 SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 150	POLYCHRO...	79 STRC	$7 \pi^- p \rightarrow n 2K_S^0$

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the isobar model A.

NODE=M147W2
NODE=M147W2

OCCUR=3

NODE=M147W2;LINKAGE=C

4π MODE 2(ππ)_S+ρρ

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
275±55		ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
375±61		AMSLER	94	CBAR 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
398±26		ADAMO	93	OBLX $\bar{n}p \rightarrow 3\pi^+ 2\pi^-$
310±50		GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$
~ 90	5751	¹ BETTINI	66	DBC 0.0 $\bar{p}n \rightarrow 2\pi^+ 3\pi^-$

¹ ρρ dominant.

NODE=M147W3;LINKAGE=BE

ηη MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
484 ⁺²⁴⁶⁺²⁴⁶ ₋₁₇₀₋₂₆₃	¹ UEHARA	10A	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta \eta$
250	AMSLER	92	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \eta \eta$
320± 40	ALDE	86D	GAM4 100 $\pi^- p \rightarrow n 2\eta$

¹ Breit-Wigner width. May also be the $f_0(1500)$.

NODE=M147W4
NODE=M147W4

NODE=M147W4;LINKAGE=UE

COUPLED CHANNEL MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
147 ⁺³⁰ ₋₅₀	¹ ANISOVICH	03	RVUE
¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p}n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.			

NODE=M147W5
NODE=M147W5

NODE=M147W;LINKAGE=KM

f₀(1370) DECAY MODES

NODE=M147215;NODE=M147

Mode	Fraction (Γ _i /Γ)
Γ ₁ π π	seen
Γ ₂ 4π	seen
Γ ₃ 4π ⁰	seen
Γ ₄ 2π ⁺ 2π ⁻	seen
Γ ₅ π ⁺ π ⁻ 2π ⁰	seen
Γ ₆ ρρ	seen
Γ ₇ 2(ππ) _S -wave	seen
Γ ₈ π(1300)π	seen
Γ ₉ a ₁ (1260)π	seen
Γ ₁₀ ηη	seen
Γ ₁₁ K $\bar{K}$	seen
Γ ₁₂ K $\bar{K}$ n π	not seen
Γ ₁₃ 6π	not seen
Γ ₁₄ ωω	not seen
Γ ₁₅ γγ	seen
Γ ₁₆ e ⁺ e ⁻	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=15;OUR EST;→ UNCHECKED ←
DESIG=16;OUR EVAL;→ UNCHECKED ←
DESIG=17;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=18;OUR EVAL;→ UNCHECKED ←
DESIG=19;OUR EVAL;→ UNCHECKED ←
DESIG=20;OUR EVAL;→ UNCHECKED ←
DESIG=12;OUR EST;→ UNCHECKED ←
DESIG=13;OUR EST;→ UNCHECKED ←

f₀(1370) PARTIAL WIDTHS

NODE=M147217

Γ(γγ)

See γγ widths under $f_0(500)$ and MORGAN 90.

Γ₁₅

NODE=M147W11
NODE=M147W11
NODE=M147W11

Γ(e⁺e⁻)

Γ₁₆

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<20	90	VOROBYEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M147W12
NODE=M147W12

$f_0(1370) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M147225

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{10} \Gamma_{15} / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

NODE=M147G01
NODE=M147G01

• • • We do not use the following data for averages, fits, limits, etc. • • •

$121^{+133+169}_{-53-106}$	¹ UEHARA	10A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \eta\eta$

¹ Including interference with the $f'_2(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M147G01;LINKAGE=UE

 $f_0(1370) \text{ BRANCHING RATIOS}$

NODE=M147220

 $\Gamma(\pi\pi) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M147R3
NODE=M147R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.10	95	OCHS	13	RVUE
0.26 ± 0.09		BUGG	96	RVUE
<0.15		¹ AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
<0.06		GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

¹ Using AMSLER 95B ($3\pi^0$).

NODE=M147R3;LINKAGE=B

 $\Gamma(4\pi) / \Gamma_{\text{total}}$ $\Gamma_2 / \Gamma = (\Gamma_3 + \Gamma_4 + \Gamma_5) / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R4
NODE=M147R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.72	GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

 $\Gamma(4\pi^0) / \Gamma(4\pi)$ Γ_3 / Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R12
NODE=M147R12

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	ABELE	96	CBAR $0.0 \bar{p}p \rightarrow 5\pi^0$
0.068 ± 0.005	¹ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

¹ Model-dependent evaluation.

NODE=M147R12;LINKAGE=GA

 $\Gamma(2\pi^+ 2\pi^-) / \Gamma(4\pi)$ $\Gamma_4 / \Gamma_2 = \Gamma_4 / (\Gamma_3 + \Gamma_4 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R5
NODE=M147R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.420 ± 0.014	¹ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow 2\pi^+ 3\pi^-$

¹ Model-dependent evaluation.

NODE=M147R5;LINKAGE=A

 $\Gamma(\pi^+ \pi^- 2\pi^0) / \Gamma(4\pi)$ $\Gamma_5 / \Gamma_2 = \Gamma_5 / (\Gamma_3 + \Gamma_4 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R6
NODE=M147R6

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.512 ± 0.019	¹ GASPERO	93	DBC $0.0 \bar{p}n \rightarrow \text{hadrons}$

¹ Model-dependent evaluation.

NODE=M147R6;LINKAGE=A

 $\Gamma(\rho\rho) / \Gamma(4\pi)$ Γ_6 / Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R17
NODE=M147R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.26 ± 0.07	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$

 $\Gamma(2(\pi\pi)_{S\text{-wave}}) / \Gamma(\pi\pi)$ Γ_7 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R15
NODE=M147R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.6 ± 2.6	¹ ABELE	01	CBAR $0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$

¹ From the combined data of ABELE 96 and ABELE 96C.

NODE=M147R;LINKAGE=KZ

 $\Gamma(2(\pi\pi)_{S\text{-wave}}) / \Gamma(4\pi)$ Γ_7 / Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M147R16
NODE=M147R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.51 ± 0.09	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$

$\Gamma(\rho\rho)/\Gamma(2\pi\pi)_{S\text{-wave}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
large	BARBERIS	00C	$450\ p\bar{p} \rightarrow p_f 4\pi p_s$
1.6 ± 0.2	AMSLER	94	CBAR $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
~ 0.65	GASPERO	93	DBC $0.0\ \bar{p}n \rightarrow \text{hadrons}$

 Γ_6/Γ_7 NODE=M147R10
NODE=M147R10

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 ± 0.06	ABELE	01B	CBAR $0.0\ \bar{p}d \rightarrow 5\pi p$

 Γ_8/Γ_2 NODE=M147R18
NODE=M147R18 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.06 ± 0.02	ABELE	01B	CBAR $0.0\ \bar{p}d \rightarrow 5\pi p$

 Γ_9/Γ_2 NODE=M147R19
NODE=M147R19 $\Gamma(\eta\eta)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(28 \pm 11) \times 10^{-3}$	¹ ANISOVICH	02D	SPEC Combined fit
$(4.7 \pm 2.0) \times 10^{-3}$	BARBERIS	00E	$450\ p\bar{p} \rightarrow p_f \eta \eta p_s$

 $\Gamma_{10}/\Gamma_2 = \Gamma_{10}/(\Gamma_3 + \Gamma_4 + \Gamma_5)$ NODE=M147R14
NODE=M147R14

¹ From a combined K-matrix analysis of Crystal Barrel ($0.\ p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R14;LINKAGE=CH

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.35 ± 0.13	BUGG	96	RVUE

 Γ_{11}/Γ NODE=M147R11
NODE=M147R11 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08 ± 0.08	ABLIKIM	05	BES2 $J/\psi \rightarrow \phi \pi^+ \pi^-, \phi K^+ K^-$
0.91 ± 0.20	¹ BARGIOTTI	03	OBLX $\bar{p}p$
0.12 ± 0.06	² ANISOVICH	02D	SPEC Combined fit
$0.46 \pm 0.15 \pm 0.11$	BARBERIS	99D	OMEG $450\ p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

 Γ_{11}/Γ_1 NODE=M147R13
NODE=M147R13

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

² From a combined K-matrix analysis of Crystal Barrel ($0.\ p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M147R;LINKAGE=BG
NODE=M147R;LINKAGE=CH $\Gamma(K\bar{K}n\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.03	GASPERO	93	DBC $0.0\ \bar{p}n \rightarrow \text{hadrons}$

 Γ_{12}/Γ NODE=M147R20
NODE=M147R20 $\Gamma(6\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.22	GASPERO	93	DBC $0.0\ \bar{p}n \rightarrow \text{hadrons}$

 Γ_{13}/Γ NODE=M147R21
NODE=M147R21 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.13	GASPERO	93	DBC $0.0\ \bar{p}n \rightarrow \text{hadrons}$

 Γ_{14}/Γ NODE=M147R22
NODE=M147R22

$\phi_0(1370)$ REFERENCES

NODE=M147

PELAEZ	23	PRL 130 051902	J.R. Pelaez, A. Rodas, J. Ruiz de Elvira (MADU+)	REFID=62199
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i> (BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i> (Crystal Barrel Collab.)	REFID=60439
AAIJ	19H	JHEP 1904 063	R. Aaij <i>et al.</i> (LHCb Collab.)	REFID=59670
AOUDE	18	PR D98 056021	R.T. Aoude <i>et al.</i>	REFID=59987
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i> (NWES)	REFID=56805
OCHS	13	JP G40 043001	W. Ochs	REFID=55367
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i> (BELLE Collab.)	REFID=53641
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev (PNPI)	REFID=52719
AUBERT	09L	PR D79 072006	B. Aubert <i>et al.</i> (BABAR Collab.)	REFID=52723
PDG	08	PL B667 1	C. Amsler <i>et al.</i> (PDG Collab.)	REFID=52166
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i> (BELLE Collab.)	REFID=52309
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i> (CLEO Collab.)	REFID=51721
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>	REFID=53252
GARMASH	07	PR D75 012006	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=51594
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=51162
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i> (PDG Collab.)	REFID=51004
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i> (ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.		
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i> (BES Collab.)	REFID=50450
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i> (BES Collab.)	REFID=50958
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i> (BELLE Collab.)	REFID=50641
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	REFID=49401
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i> (OBELIX Collab.)	REFID=49217
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	REFID=49423
		Translated from YAF 66 860.		
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	REFID=48831
		Translated from YAF 65 1583.		
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=48334
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=48356
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i> (FNAL E791 Collab.)	REFID=48004
ASNER	00	PR D61 012002	D.M. Asner <i>et al.</i> (CLEO Collab.)	REFID=47339
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=47959
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=47961
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i> (Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i> (Omega Expt.)	REFID=47395
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>	REFID=47400
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau (CRAC, PARIN)	REFID=46927
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i> (GAM4 Collab.)	REFID=46605
Also		PAN 62 405	D. Alde <i>et al.</i> (GAMS Collab.)	REFID=46914
		Translated from YAF 62 446.		
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	REFID=46331
		Translated from UFN 168 481.		
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i> (OBELIX Collab.)	REFID=45782
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i> (WA 102 Collab.)	REFID=45758
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i> (OBELIX Collab.)	REFID=45701
ABELE	96	PL B380 453	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45011
ABELE	96B	PL B385 425	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45038
ABELE	96C	NP A609 562	A. Abele <i>et al.</i> (Crystal Barrel Collab.)	REFID=45076
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou (LOQM, PNPI)	REFID=45094
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44377
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44440
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44441
JANSEN	95	PR D52 2690	G. Janssen <i>et al.</i> (STON, ADLD, JULI)	REFID=44508
TORNQVIST	95	ZPHY C68 647	N.A. Tornqvist (HELS)	REFID=44529
AMSLER	94	PL B322 431	C. Amsler <i>et al.</i> (Crystal Barrel Collab.) JPC	REFID=43660
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=44093
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i> (Crystal Barrel Collab.) JPC	REFID=43659
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i> (LOQM)	REFID=44078
KAMINSKI	94	PR D50 3145	R. Kaminski, L. Lesniak, J.P. Maillet (CRAC+)	REFID=45771
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i> (OBELIX Collab.) JPC	REFID=43657
GASPERO	93	NP A562 407	M. Gaspero (ROMA) JPC	REFID=43658
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i> (Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i> (ATHU, BARI, BIRM+)	REFID=41744
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i> (ATHU, BARI, BIRM+)	REFID=41862
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i> (ISU, BGNA, CERN+)	REFID=41376
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington (RAL, DURH)	REFID=41583
ASTON	88	NP B296 493	D. Aston <i>et al.</i> (SLAC, NAGO, CINC, INUS)	REFID=40262
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i> (ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i> (CLER, FRAS, LALO+)	REFID=40576
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i> (NOVO)	REFID=41023
		Translated from YAF 48 436.		
AU	87	PR D35 1633	K.L. Au, D. Morgan, M.R. Pennington (DURH, RAL)	REFID=40064
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i> (Axial Field Spec. Collab.)	REFID=21123
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i> (BELG, LAPP, SERP, CERN+)	REFID=20765
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i> (BNL, BRAN, CUNY+)	REFID=20768
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i> (BELG, LAPP, SERP+)	REFID=21418
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i> (BELG, LAPP, SERP+)	REFID=20750
CASON	83	PR D28 1586	N.M. Cason <i>et al.</i> (NDAM, ANL)	REFID=20752
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i> (BNL, CUNY, TUFTS, VAND)	REFID=20390
WICKLUND	80	PRL 45 1469	A.B. Wicklund <i>et al.</i> (ANL)	REFID=20383
BECKER	79	NP B151 46	H. Becker <i>et al.</i> (MPIM, CERN, ZEEM, CRAC)	REFID=21084
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i> (NDAM, ANL)	REFID=20378
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen (GLAS, NORD)	REFID=21072
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i> (GEVA, SACL)	REFID=11004
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i> (CERN, MPIM)	REFID=20355
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i> (CERN, MPIM)	REFID=20113
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i> (CERN, MPIM)	REFID=20107
OCHS	73	Thesis	W. Ochs (MPIM, MUNI)	REFID=20349
BEIER	72B	PRL 29 511	E.W. Beier <i>et al.</i> (PENN)	REFID=44530
BETTINI	66	NC 42A 695	A. Bettini <i>et al.</i> (PADO, PISA)	REFID=21361

$\pi_1(1400)$

$$J^{PC} = 1^-(1^+)$$

OMITTED FROM SUMMARY TABLE

Coupled channel analyses (see e.g. ALBRECHT 20) favor the existence of only one broad 1^-+ isovector state consistent with $\pi_1(1600)$ in the 1400–1600 MeV region. See the review on "Spectroscopy of Light Meson Resonances". See also $\pi_1(1600)$.

NODE=M111

NODE=M111

 $\pi_1(1400)$ REFERENCESALBRECHT 20 EPJ C80 453 M. Albrecht *et al.* (Crystal Barrel Collab.)

NODE=M111

REFID=60439

NODE=M027

 $\eta(1405)$

$$J^{PC} = 0^+(0^-)$$

See also the $\eta(1475)$.

NODE=M027

NODE=M027205

NODE=M027MX

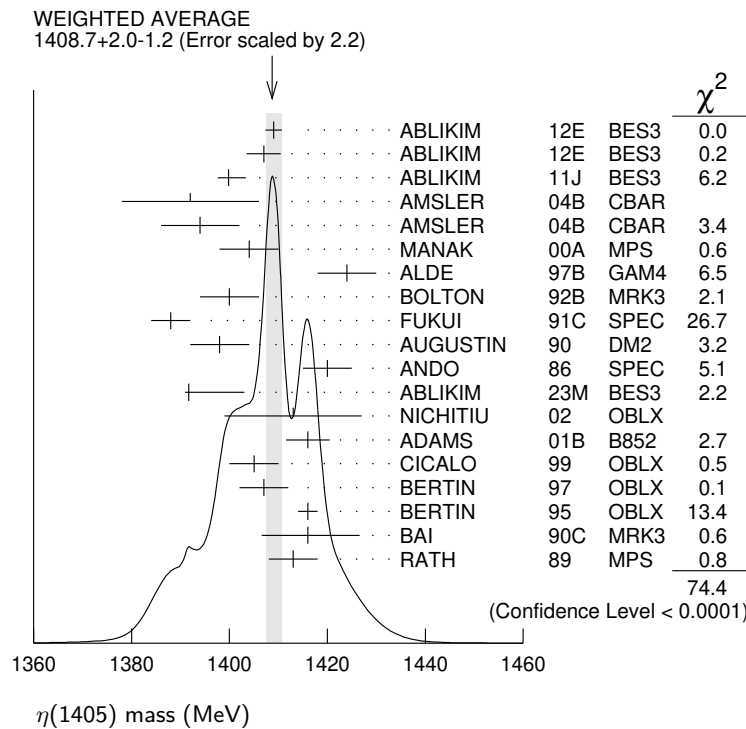
NEW

 $\eta(1405)$ MASS

VALUE (MeV) DOCUMENT ID

1408.7^{+2.0}_{-1.2} OUR AVERAGE Includes data from the 2 datablocks that follow this one.

Error includes scale factor of 2.2. See the ideogram below. [1408.8 ± 2.0 MeV OUR 2023 AVERAGE Scale factor = 2.2]

 $\eta\pi\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

1405.8 ± 2.6 OUR AVERAGE Error includes scale factor of 2.3. See the ideogram below.

1409.0 ± 1.7	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
1407.0 ± 3.5	198	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$
1399.8 ± 2.2 ^{+2.8} _{-0.1}	1	ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
1392 ± 14	900 ± 375	AMSLER	04B CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$

NODE=M027M1

NODE=M027M1

OCCUR=2

1394 ± 8	6.6 ± 2.0k	AMSLER	04B CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta$
1404 ± 6	9082	MANAK	00A MPS	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1424 ± 6	2200	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1400 ± 6		² BOLTON	92B MRK3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
1388 ± 4		FUKUI	91C SPEC	$8.95 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1398 ± 6	261	³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
1420 ± 5		ANDO	86 SPEC	$8 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1404.0 ± 11.0	195	ABLIKIM	19BABES3	$e^+ e^- \rightarrow \psi(2S)$
1385 ± 7		BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
1409 ± 3		⁴ AMSLER	95F CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta$

¹ The selected process is $J/\psi \rightarrow \omega a_0(980) \pi$.

² From fit to the $a_0(980) \pi 0^-+$ partial wave.

³ Best fit with a single Breit Wigner.

⁴ Superseded by AMSLER 04B.

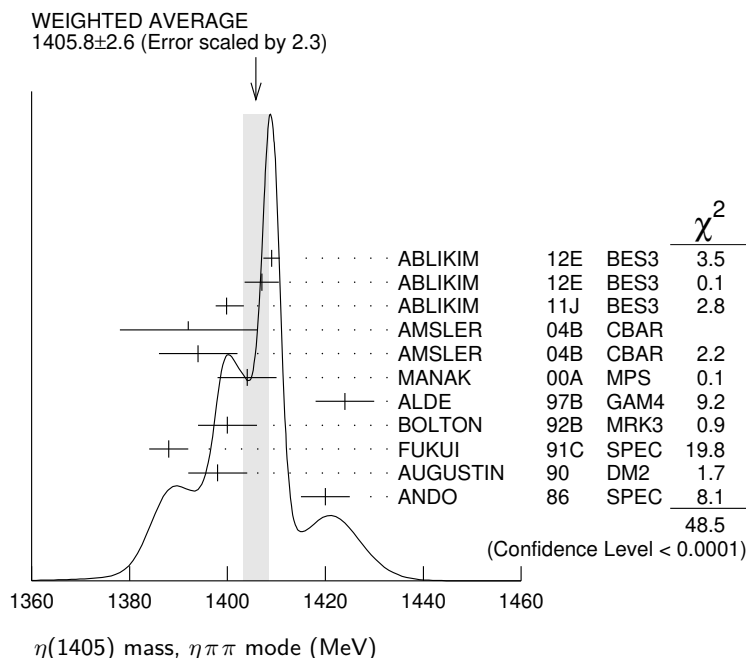
OCCUR=2

NODE=M027M1;LINKAGE=BL

NODE=M027M1;LINKAGE=J1

NODE=M027M1;LINKAGE=A1

NODE=M027M1;LINKAGE=A



$K \bar{K} \pi$ MODE ($a_0(980) \pi$ or direct $K \bar{K} \pi$)

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M027M4

NODE=M027M4

1413.5 ± 2.0 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. [1413.9 ± 1.7 MeV OUR 2023 AVERAGE Scale factor = 1.1]

NEW

1391.7 ± 0.7 ± 11.3 0.3	126k	¹ ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1413 ± 14	3651	² NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1416 ± 4 ± 2	20k	ADAMS	01B	B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1405 ± 5		³ CICALO	99	OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1407 ± 5		³ BERTIN	97	OBLX	$0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1416 ± 2		³ BERTIN	95	OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
1416 ± 8 ± 7 5	700	⁴ BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1413 ± 5		⁴ RATH	89	MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

1459 ± 5		⁵ AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

¹ ABLIKIM 23M reports for this state a significance from the fit much higher than 35 σ .

² Decaying dominantly directly to $K^+ K^- \pi^0$.

³ Decaying into $(K \bar{K})_S \pi$, $(K \pi)_S \bar{K}$, and $a_0(980) \pi$.

⁴ From fit to the $a_0(980) \pi 0^-+$ partial wave. Cannot rule out a $a_0(980) \pi 1^-+$ partial wave.

⁵ Excluded from averaging because averaging would be meaningless.

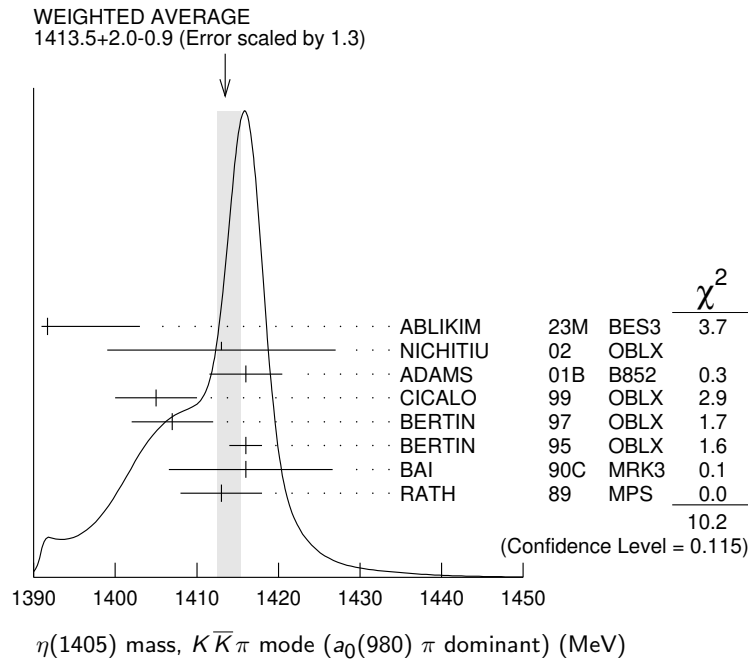
NODE=M027M4;LINKAGE=A

NODE=M027M;LINKAGE=NC

NODE=M027M4;LINKAGE=FX

NODE=M027M4;LINKAGE=C2

NODE=M027M4;LINKAGE=AA

 **$\pi\pi\gamma$ MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1403±17 OUR AVERAGE Error includes scale factor of 1.8.				
1390±12	235 ± 91	AMSLER	04B CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
1424±10±11	547	BAI	04J BES2	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1401±18		^{1,2} AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+\pi^-\gamma\gamma$
1432± 8		² COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+\pi^-2\gamma$

¹ Best fit with a single Breit Wigner.² This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.NODE=M027M2
NODE=M027M2

OCCUR=4

NODE=M027M2;LINKAGE=E
NODE=M027M2;LINKAGE=X **4π MODE**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1420±20		BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1489±12	3270	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

¹ Estimated by us from various fits.NODE=M027M3
NODE=M027M3

NODE=M027M3;LINKAGE=E

 $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1452.7± 3.3	191	^{1,2} ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
1437.6± 3.2	249 ± 35	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp + \text{c.c.}$
1445.9± 5.7	62 ± 18	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^\pm K^\mp \pi^0$
1442 ± 10	410	¹ BAI	98C BES	$J/\psi \rightarrow \gamma K^\pm K^\mp \pi^0$
1445 ± 8	693	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1433 ± 8	296	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^\pm K^\mp \pi^0$
1413 ± 8	500	¹ DUCH	89 ASTE	$\bar{p}p \rightarrow \pi^+\pi^- K^\pm \pi^\mp K^0$
1453 ± 7	170	¹ RATH	89 MPS	$21.4\pi^-p \rightarrow K_S^0 K_S^0 \pi^0 n$
1419 ± 1	8800	¹ BIRMAN	88 MPS	$8\pi^-p \rightarrow K^\pm K^0 \pi^\mp n$
1424 ± 3	620	¹ REEVES	86 SPEC	$6.6p\bar{p} \rightarrow K\bar{K}\pi X$
1421 ± 2		¹ CHUNG	85 SPEC	$8\pi^-p \rightarrow K\bar{K}\pi n$
1440 ⁺²⁰ ₋₁₅	174	¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^\pm K^\mp \pi^0$
1440 ⁺¹⁰ ₋₁₅		¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 7	800	^{1,3} BAILLON	67 HBC	$0\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$

¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.² Systematic uncertainty not evaluated.³ From best fit of 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.NODE=M027M6
NODE=M027M6

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M027M;LINKAGE=NP

NODE=M027M;LINKAGE=NS

NODE=M027M6;LINKAGE=H

$\eta(1405)$ WIDTH

VALUE (MeV)

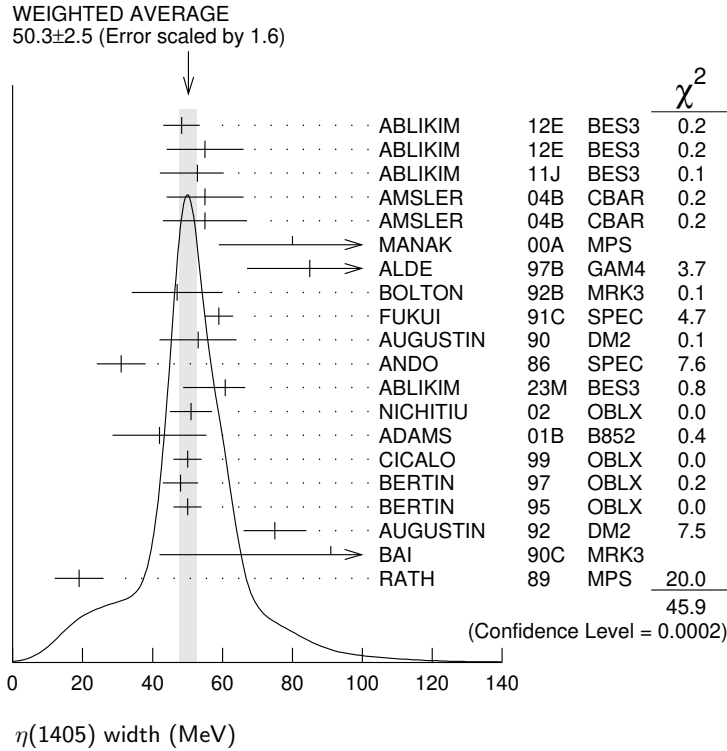
DOCUMENT ID

50.3 $\pm$ 2.5 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.6. See the ideogram below. [50.1 $\pm$ 2.6 MeV OUR 2023 AVERAGE Scale factor = 1.7]

NODE=M027210

NODE=M027WX

NEW

 **$\eta\pi\pi$ MODE**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M027W1
NODE=M027W1

52.6 $\pm$ 3.2 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

48.3 $\pm$ 5.2	743	ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
55.0 $\pm$ 11.0	198	ABLIKIM	12E	BES3	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$
52.8 $\pm$ 7.6 ^{+0.1} _{-7.6}	1	ABLIKIM	11J	BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
55 $\pm$ 11	900	AMSLER	04B	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
55 $\pm$ 12	6.6k	AMSLER	04B	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\gamma$
80 $\pm$ 21	9.0k	MANAK	00A	MPS	$18 \pi^-p \rightarrow \eta\pi^+\pi^-n$
85 $\pm$ 18	2.2k	ALDE	97B	GAM4	$100 \pi^-p \rightarrow \eta\pi^0\pi^0n$
47 $\pm$ 13	2	BOLTON	92B	MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
59 $\pm$ 4		FUKUI	91C	SPEC	$8.95 \pi^-p \rightarrow \eta\pi^+\pi^-n$
53 $\pm$ 11	3	AUGUSTIN	90	DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
31 $\pm$ 7		ANDO	86	SPEC	$8 \pi^-p \rightarrow \eta\pi^+\pi^-n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

79.0 $\pm$ 16.0	195	ABLIKIM	19BA	BES3	$e^+e^- \rightarrow \psi(2S)$
86 $\pm$ 10	4	AMSLER	95F	CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

¹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.

² From fit to the $a_0(980)\pi^0\pi^+\pi^-$ partial wave.

³ From $\eta\pi^+\pi^-$ mass distribution - mainly $a_0(980)\pi$ - no spin-parity determination available.

⁴ Superseded by AMSLER 04B.

OCCUR=2

OCCUR=2

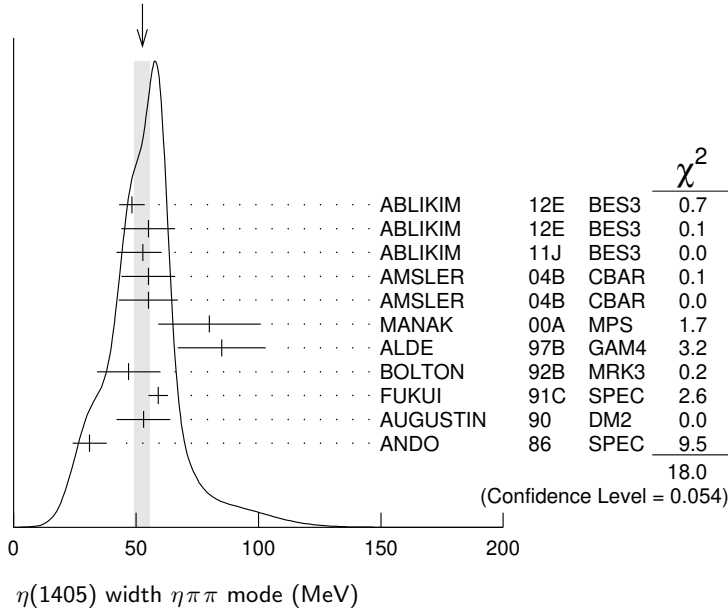
NODE=M027W1;LINKAGE=BL

NODE=M027W1;LINKAGE=A1

NODE=M027W1;LINKAGE=D1

NODE=M027W1;LINKAGE=A

WEIGHTED AVERAGE
52.6±3.2 (Error scaled by 1.3)



$K\bar{K}\pi$ MODE ($a_0(980)\pi$ or direct $K\bar{K}\pi$)

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M027W4
NODE=M027W4

49 ± 4 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.
[48 ± 4 MeV OUR 2023 AVERAGE Scale factor = 2.1]

NEW

60.8 ± 1.2 ^{+5.5} _{-12.0}	126K	ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
51 ± 6	3651	¹ NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
42 ± 10 ± 9	20k	ADAMS	01B	B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
50 ± 4		CICALO	99	OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
48 ± 5		² BERTIN	97	OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
50 ± 4		² BERTIN	95	OBLX	$0 \bar{p} p \rightarrow K\bar{K} \pi \pi \pi$
75 ± 9		AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K\bar{K} \pi$
91 ⁺⁶⁷ ₋₃₁ ⁺¹⁵ ₋₃₈		³ BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
19 ± 7		³ RATH	89	MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

OCCUR=2

OCCUR=3

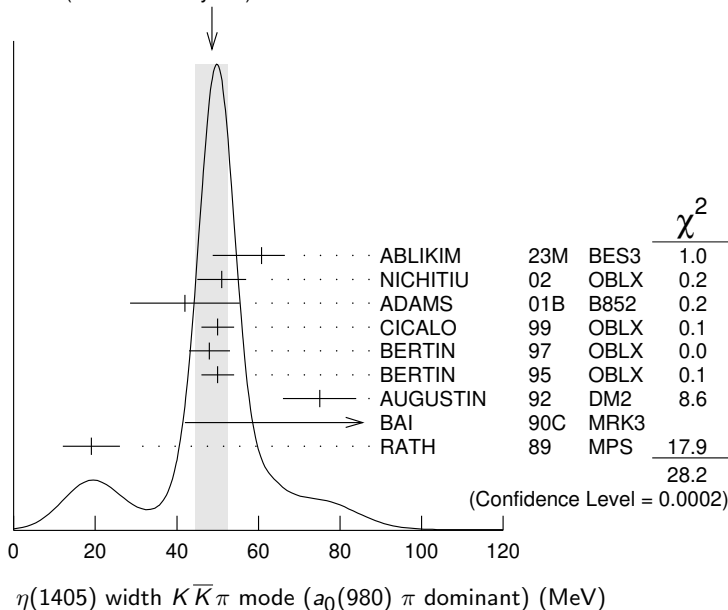
¹Decaying dominantly directly to $K^+ K^- \pi^0$.

²Decaying into $(K\bar{K})_S \pi$, $(K\pi)_S \bar{K}$, and $a_0(980)\pi$.

³From fit to the $a_0(980)\pi 0^- +$ partial wave, but $a_0(980)\pi 1^+ +$ cannot be excluded.

NODE=M027W;LINKAGE=NC
NODE=M027W4;LINKAGE=FX
NODE=M027W4;LINKAGE=C

WEIGHTED AVERAGE
49±4 (Error scaled by 2.0)



$\pi\pi\gamma$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
89 ±17 OUR AVERAGE	Error includes scale factor of 1.7.			
64 ±18	235 ± 91	AMSLER	04B CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
101.0 ± 8.8 ± 8.8	547	BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
174 ±44		AUGUSTIN	90 DM2	$J/\psi \rightarrow \pi^+ \pi^- \gamma \gamma$
90 ±26		¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \pi^+ \pi^- 2\gamma$

¹ This peak in the $\gamma\rho$ channel may not be related to the $\eta(1405)$.

NODE=M027W2
NODE=M027W2

OCCUR=2

NODE=M027W2;LINKAGE=X

 4π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
160 ±30		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
144 ±13	3270	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi \gamma$

¹ Estimated by us from various fits.

NODE=M027W3
NODE=M027W3

NODE=M027W3;LINKAGE=F2

 $K\bar{K}\pi$ MODE (unresolved)

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
45.9 ± 8.2	191	^{1,2} ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K K \pi$
48.9 ± 9.0	249 ± 35	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + \text{c.c.}$
34.2 ± 18.5	62 ± 18	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
93 ±14	296	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
105 ±10	693	¹ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
62 ±16	500	¹ DUCH	89 ASTE	$\bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
100 ±11	170	¹ RATH	89 MPS	$21.4 \pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
66 ± 2	8800	¹ BIRMAN	88 MPS	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
60 ±10	620	¹ REEVES	86 SPEC	$6.6 p \bar{p} \rightarrow K K \pi X$
60 ±10		¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K \bar{K} \pi n$
55 ⁺²⁰ ₋₃₀	174	¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
50 ⁺³⁰ ₋₂₀		¹ SCHARRE	80 MRK2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
80 ±10	800	^{1,3} BAILLON	67 HBC	$0.0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$

¹ These experiments identify only one pseudoscalar in the 1400–1500 range. Data could also refer to $\eta(1475)$.

² Systematic uncertainty not evaluated.

³ From best fit to 0^-+ partial wave, 50% $K^*(892)K$, 50% $a_0(980)\pi$.

NODE=M027W6
NODE=M027W6

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M027W;LINKAGE=NP

NODE=M027W;LINKAGE=NS

NODE=M027W6;LINKAGE=H1

 $\eta(1405)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\bar{K}\pi$	seen	
Γ_2 $\eta\pi\pi$	seen	
Γ_3 $a_0(980)\pi$	seen	
Γ_4 $\eta(\pi\pi)_S\text{-wave}$	seen	
Γ_5 $f_0(980)\pi^0 \rightarrow \pi^+ \pi^- \pi^0$	not seen	
Γ_6 $f_0(980)\eta$	seen	
Γ_7 4π	seen	
Γ_8 $\rho\rho$	<58 %	99.85%
Γ_9 $\gamma\gamma$		
Γ_{10} $\rho^0\gamma$	seen	
Γ_{11} $\phi\gamma$		
Γ_{12} $K^*(892)K$	seen	

NODE=M027215;NODE=M027

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=9;OUR EST;→ UNCHECKED ←
DESIG=15
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←
DESIG=12
DESIG=7
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=13
DESIG=11;OUR EST;→ UNCHECKED ←

 $\eta(1405) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.035 90 ^{1,2} AHOHE 05 CLE2 10.6 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$

¹ Using $\eta(1405)$ mass and width 1410 MeV and 51 MeV, respectively.

² Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M027220

NODE=M027G3
NODE=M027G3

NODE=M027G3;LINKAGE=AH

NODE=M027G3;LINKAGE=B3

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.095	95	ACCIARRI	01G L3	183–202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$

 $\Gamma_2\Gamma_9/\Gamma$

NODE=M027G5
NODE=M027G5

 $\Gamma(\rho^0\gamma) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.5	95	ALTHOFF	84E TASS	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$

 $\Gamma_{10}\Gamma_9/\Gamma$

NODE=M027G8
NODE=M027G8

 $\eta(1405)$ BRANCHING RATIOS

NODE=M027225

 $\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.09±0.48		¹ AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.5	90	EDWARDS	83B CBAL	$J/\psi \rightarrow \eta\pi\pi\gamma$
<1.1	90	SCHARRE	80 MRK2	$J/\psi \rightarrow \eta\pi\pi\gamma$
<1.5	95	FOSTER	68B HBC	0.0 $\bar{p}p$

 Γ_2/Γ_1

NODE=M027R3
NODE=M027R3

¹ Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.

NODE=M027R3;LINKAGE=AM

 $\Gamma(\rho^0\gamma)/\Gamma(\eta\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.111±0.064	AMSLER	04B CBAR	0 $\bar{p}p$

 Γ_{10}/Γ_2

NODE=M027R12
NODE=M027R12

 $\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.15		¹ BERTIN	95 OBLX	$0 \bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
~ 0.8	500	¹ DUCH	89 ASTE	$\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\pi^0$
~ 0.75		¹ REEVES	86 SPEC	6.6 $p\bar{p} \rightarrow K\bar{K}\pi X$

 Γ_3/Γ_1

NODE=M027R4
NODE=M027R4

¹ Assuming that the $a_0(980)$ decays only into $K\bar{K}$.

NODE=M027R4;LINKAGE=C

 $\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.29±0.10		ABELE	98E CBAR	$0 p\bar{p} \rightarrow \eta\pi^0\pi^0\pi^0$
0.19±0.04	2200	¹ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$
0.56±0.04±0.03		¹ AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

 Γ_3/Γ_2

NODE=M027R2
NODE=M027R2

¹ Assuming that the $a_0(980)$ decays only into $\eta\pi$.

NODE=M027R2;LINKAGE=A

 $\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)S\text{-wave})$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.91±0.12		ANISOVICH	01 SPEC	$0.0 \bar{p}p \rightarrow \eta\pi^+\pi^-\pi^+\pi^-$
0.15±0.04	9082	¹ MANAK	00A MPS	18 $\pi^-p \rightarrow \eta\pi^+\pi^-n$
0.70±0.12±0.20		² BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

 Γ_3/Γ_4

NODE=M027R9
NODE=M027R9

¹ Statistical error only.² Assuming that the $a_0(980)$ decays only into $\eta\pi$.

NODE=M027R;LINKAGE=K3
NODE=M027R9;LINKAGE=BK

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0152±0.0038	¹ COFFMAN	90 MRK3	$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

 Γ_{10}/Γ_1

NODE=M027R7
NODE=M027R7

¹ Using $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma K\bar{K}\pi)=4.2 \times 10^{-3}$ and $B(J/\psi \rightarrow \gamma\eta(1405) \rightarrow \gamma\gamma\rho^0)=6.4 \times 10^{-5}$.

NODE=M027R7;LINKAGE=D

 $\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.78 × 10⁻³	90	¹ ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

 Γ_9/Γ_1

NODE=M027R02
NODE=M027R02

¹ Using results from BAI 00D.

NODE=M027R02;LINKAGE=A

 $\Gamma(\eta(\pi\pi)S\text{-wave})/\Gamma(\eta\pi\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.81±0.04	2200	ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$

 Γ_4/Γ_2

NODE=M027R8
NODE=M027R8

$\Gamma(f_0(980)\eta)/\Gamma(\eta\pi\pi)$ Γ_6/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
0.32±0.07	¹ ANISOVICH 00	SPEC	0.9–1.2 $\bar{p}p \rightarrow \eta 3\pi^0$

¹ Using preliminary Crystal Barrel data.

NODE=M027R10
 NODE=M027R10

NODE=M027R10;LINKAGE=D

 $\Gamma(f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 17AJ	BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$
¹ ABLIKIM 17AJ reports $B(\psi(2S) \rightarrow \gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0) < 5.0 \times 10^{-7}$.			

NODE=M027R00
 NODE=M027R00

NODE=M027R00;LINKAGE=A

 $\Gamma(\rho\rho)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.58	99.85	^{1,2} AMSLER 04B	CBAR	0 $\bar{p}p$
¹ Assuming that the $\eta(1405)$ decays are saturated by the $\pi\pi\eta$, $K\bar{K}\pi$ and $\rho\rho$ modes.				
² Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.				

NODE=M027R13
 NODE=M027R13

NODE=M027R13;LINKAGE=AM
 NODE=M027R13;LINKAGE=AS

 $\Gamma(K^*(892)K)/\Gamma(a_0(980)\pi)$ Γ_{12}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.084±0.024	¹ ADAMS 01B	B852	18 GeV $\pi^-p \rightarrow K^+K^-\pi^0n$
¹ Statistical error only.			

NODE=M027R11
 NODE=M027R11

NODE=M027R11;LINKAGE=K3

 $\Gamma(\phi\gamma)/\Gamma(\rho^0\gamma)$ Γ_{11}/Γ_{10}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.09±0.03		¹ ABLIKIM 18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
0.13±0.04		² ABLIKIM 18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
<0.77	95	³ BAI 04J	BES2	$J/\psi \rightarrow \gamma\gamma K^+K^-$
¹ Constructive interference between $X(1835)$ and $\eta(1405)/\eta(1475)$ decays to $\gamma\phi$ is assumed. Also see $\eta(1475)$. ABLIKIM 18I reports the inverse as 11.10 ± 3.5 .				
² Destructive interference between $X(1835)$ and $\eta(1405)/\eta(1475)$ decays to $\gamma\phi$ is assumed. Also see $\eta(1475)$. ABLIKIM 18I reports the inverse as 7.53 ± 2.49 .				
³ Calculated by us from $B(J/\psi \rightarrow \eta(1405)\gamma \rightarrow \phi\gamma\gamma) < 0.82 \times 10^{-4}$ and $B(J/\psi \rightarrow \eta(1405)\gamma \rightarrow \rho^0\gamma\gamma) = (1.07 \pm 0.17 \pm 0.11) \times 10^{-4}$.				

NODE=M027R14
 NODE=M027R14

OCCUR=2

NODE=M027R14;LINKAGE=A

NODE=M027R14;LINKAGE=B

NODE=M027R14;LINKAGE=BA

 $\eta(1405)$ REFERENCES

NODE=M027

ABLIKIM 23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)
AHOHE 05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
AMSLER 04B	EPJ C33 23	C. Amser <i>et al.</i>	(Crystal Barrel Collab.)
BAI 04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)
NICHITIU 02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI 01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS 01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH 01	NP A690 567	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00	PL B472 168	A.V. Anisovich <i>et al.</i>	
BAI 00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)
MANAK 00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)
BAI 99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)
CICALO 99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
ABELE 98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BAI 98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)
ALDE 97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)
Translated from YAF 60 458.			
BERTIN 97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AMSLER 95F	PL B358 389	C. Amser <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN 95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BUGG 95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
AUGUSTIN 92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BOLTON 92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)
FUKUI 91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN 90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)
BAI 90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
COFFMAN 90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)
BISELLO 89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
DUCH 89	ZPHY C45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP
RATH 89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
BIRMAN 88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
ANDO 86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP
REEVES 86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP
CHUNG 85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP
ALTHOFF 84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)
EDWARDS 83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
EDWARDS 82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
Also	PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
SCHARRE 80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)
FOSTER 68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)
BAILLON 67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

REFID=62055
 REFID=60024
 REFID=58893
 REFID=58925
 REFID=58322
 REFID=55386
 REFID=54270
 REFID=53931
 REFID=52143
 REFID=50764
 REFID=51079
 REFID=50167
 REFID=48848
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 REFID=48308
 REFID=47429
 REFID=47954
 REFID=47989
 REFID=46606
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 REFID=46314
 REFID=46337
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REFID=45417
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 REFID=41352
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 REFID=40924
 REFID=40568
 REFID=20891
 REFID=20936
 REFID=20934
 REFID=20305
 REFID=21318
 REFID=21314
 REFID=21315
 REFID=21329
 REFID=21179
 REFID=20407

$h_1(1415)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

NODE=M109

 $h_1(1415)$ MASS

NODE=M109M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M109M

1409^{+9}_{-8} OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

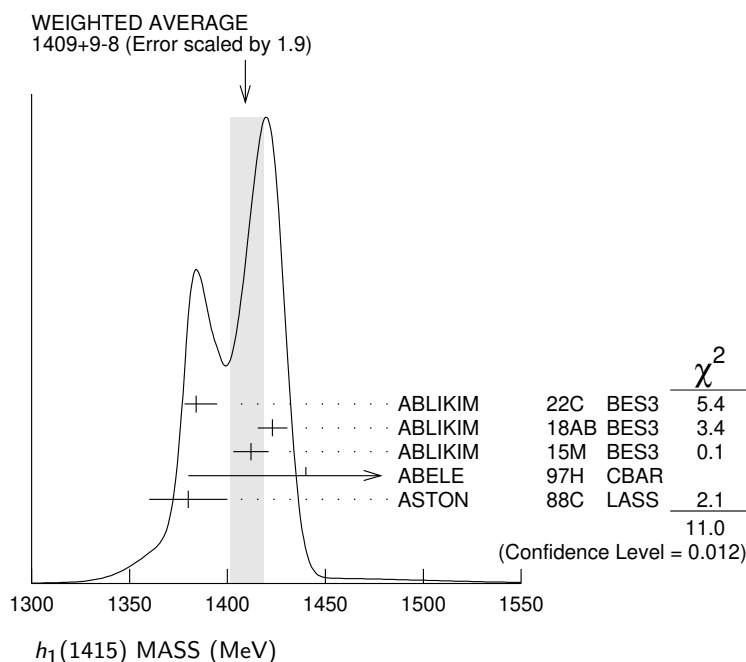
1384 ± 6	$^{+9}_{-0}$	¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
1423 ± 2.1 ± 7.3	2.2k	² ABLIKIM	18AB	BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
1412 ± 4 ± 8		² ABLIKIM	15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma \phi(h_1 \rightarrow K^* \bar{K})$
1440 ± 60		ABELE	97H	CBAR	$\bar{p} p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
1380 ± 20		ASTON	88C	LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M109M;LINKAGE=B

² Final states $K^+ K^- \pi^0$ and $K_S^0 K^\pm \pi^\mp$.

NODE=M109M;LINKAGE=A

 **$h_1(1415)$ WIDTH**

NODE=M109W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M109W

78 ± 11 OUR AVERAGE

66 ± 10	$^{+12}_{-10}$	¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
90.3 ± 9.8 ± 17.5	2.2k	² ABLIKIM	18AB	BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
84 ± 12 ± 40		² ABLIKIM	15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c1,2} \rightarrow \gamma \phi(h_1 \rightarrow K^* \bar{K})$
170 ± 80		ABELE	97H	CBAR	$\bar{p} p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
80 ± 30		ASTON	88C	LASS	$11 K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M109W;LINKAGE=B

² Final states $K^+ K^- \pi^0$ and $K_S^0 K^\pm \pi^\mp$.

NODE=M109W;LINKAGE=A

$h_1(1415)$ DECAY MODES

NODE=M109215;NODE=M109

Mode	
Γ_1	$K \bar{K}^*(892) + \text{c.c.}$

DESIG=1

 $h_1(1415)$ REFERENCES

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18AB	PR D98 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M109

REFID=61637
 REFID=59456
 REFID=56778
 REFID=45765
 REFID=40282

 $f_1(1420)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M006

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M006

 $f_1(1420)$ MASS

NODE=M006M2

NODE=M006M2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

$1428.4^{+1.5}_{-1.3}$ OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below. $[1426.3 \pm 0.9 \text{ MeV OUR 2023 AVERAGE Scale factor} = 1.1]$

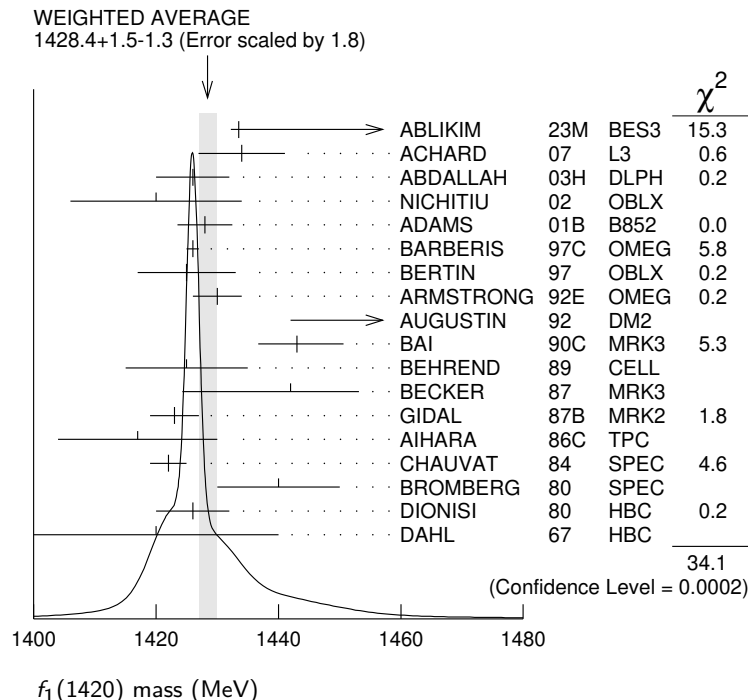
NEW

1433.5 ± 1.1	$^{+27.9}_{-0.7}$	126K	ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1434 ± 5	± 5	133	¹ ACHARD	07	L3	$183\text{--}209 \text{ e}^+ \text{e}^- \rightarrow \text{e}^+ \text{e}^- K_S^0 K^\pm \pi^\mp$
1426 ± 6		711	ABDALLAH	03H	DLPH	$91.2 \text{ e}^+ \text{e}^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
1420 ± 14		3651	NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1428 ± 4	± 2	20k	ADAMS	01B	B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1426 ± 1			BARBERIS	97C	OMEG	$450 \text{ } p p \rightarrow p p K_S^0 K^\pm \pi^\mp$
1425 ± 8			BERTIN	97	OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1430 ± 4			² ARMSTRONG	92E	OMEG	$85,300 \pi^+ p, p p \rightarrow \pi^+ p, p p (K \bar{K} \pi)$
1462 ± 20			³ AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
1443 $^{+7}_{-6}$	$^{+3}_{-2}$	1100	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1425 ± 10		17	BEHREND	89	CELL	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1442 ± 5	$^{+10}_{-17}$	111	BECKER	87	MRK3	$\text{e}^+ \text{e}^-, \omega K \bar{K} \pi$
1423 ± 4			GIDAL	87B	MRK2	$\text{e}^+ \text{e}^- \rightarrow \text{e}^+ \text{e}^- K \bar{K} \pi$
1417 ± 13		13	AIHARA	86C	TPC	$\text{e}^+ \text{e}^- \rightarrow \text{e}^+ \text{e}^- K \bar{K} \pi$
1422 ± 3			CHAUVAT	84	SPEC	$\text{ISR } 31.5 \text{ } p p$
1440 ± 10			⁴ BROMBERG	80	SPEC	$100 \pi^- p \rightarrow K \bar{K} \pi X$
1426 ± 6		221	DIONISI	80	HBC	$4 \pi^- p \rightarrow K \bar{K} \pi n$
1420 ± 20			DAHL	67	HBC	$1.6\text{--}4.2 \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
1430.8 ± 0.9			⁵ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$
1433.4 ± 0.8			⁵ SOSA	99	SPEC	$p p \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
1435 ± 9			PROKOSHKIN	97B	GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
1429 ± 3		389	ARMSTRONG	89	OMEG	$300 \text{ } p p \rightarrow K \bar{K} \pi p p$
1425 ± 2		1520	ARMSTRONG	84	OMEG	$85 \pi^+ p, p p \rightarrow (\pi^+, p) (K \bar{K} \pi) p$
~ 1420			BITYUKOV	84	SPEC	$32 K^- p \rightarrow K^+ K^- \pi^0 \gamma$

OCCUR=2

- ¹ From a fit with a width fixed at 55 MeV.
² This result supersedes ARMSTRONG 84, ARMSTRONG 89.
³ From fit to the $K^*(892)K$ 1^{++} partial wave.
⁴ Mass error increased to account for $a_0(980)$ mass cut uncertainties.
⁵ No systematic error given.

NODE=M006M2;LINKAGE=CH
 NODE=M006M2;LINKAGE=C
 NODE=M006M2;LINKAGE=B
 NODE=M006M2;LINKAGE=A
 NODE=M006M2;LINKAGE=N1



$f_1(1420)$ WIDTH

NODE=M006W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
56.7 ± 3.3 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below. [54.5 ± 2.6 MeV OUR 2023 AVERAGE]		
95.9 ± 2.3 ^{+13.6} _{-10.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
51 ± 14	711	ABDALLAH	03H DLPH	$91.2 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
61 ± 8	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
38 ± 9 ± 6	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
58 ± 4		BARBERIS	97C OMEG	450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
45 ± 10		BERTIN	97 OBLX	0.0 $\bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
58 ± 10		⁶ ARMSTRONG	92E OMEG	85,300 $\pi^+ p, pp \rightarrow \pi^+ p, pp (K \bar{K} \pi)$
129 ± 41		⁷ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
68 ⁺²⁹ ₋₁₈ ± 8 ₋₉	1100	BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
42 ± 22	17	BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
40 ⁺¹⁷ ₋₁₃ ± 5	111	BECKER	87 MRK3	$e^+ e^- \rightarrow \omega K \bar{K} \pi$
35 ⁺⁴⁷ ₋₂₀	13	AIHARA	86C TPC	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
47 ± 10		CHAU VAT	84 SPEC	ISR 31.5 pp
62 ± 14		BROMBERG	80 SPEC	100 $\pi^- p \rightarrow K \bar{K} \pi X$
40 ± 15	221	DIONISI	80 HBC	4 $\pi^- p \rightarrow K \bar{K} \pi n$
60 ± 20		DAHL	67 HBC	1.6-4.2 $\pi^- p$

NODE=M006W

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

68.7 ± 2.9

⁸ SOSA

99

SPEC

$pp \rightarrow p_{\text{slow}} (K_S^0 K^+ \pi^-) p_{\text{fast}}$

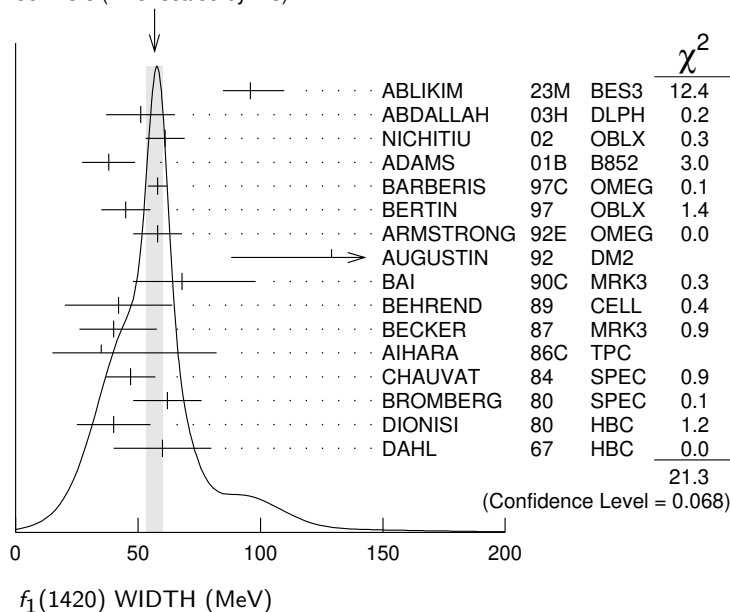
58.8 ± 3.3		⁸ SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}} (K_S^0 K^- \pi^+) p_{\text{fast}}$
90 ± 25		PROKOSHKIN 97B	GAM4	100	$\pi^- p \rightarrow \eta \pi^0 \pi^0 n$
58 ± 8	389	ARMSTRONG 89	OMEG	300	$pp \rightarrow K \bar{K} \pi pp$
62 ± 5	1520	ARMSTRONG 84	OMEG	85	$\pi^+ p, pp \rightarrow (\pi^+, p)(K \bar{K} \pi) p$
~ 50		BITYUKOV 84	SPEC	32	$K^- p \rightarrow K^+ K^- \pi^0 \gamma$

OCCUR=2

⁶ This result supersedes ARMSTRONG 84, ARMSTRONG 89.⁷ From fit to the $K^*(892) K 1^{++}$ partial wave.⁸ No systematic error given.

NODE=M006W;LINKAGE=C
 NODE=M006W;LINKAGE=B
 NODE=M006W;LINKAGE=N1

WEIGHTED AVERAGE
 56.7 ± 3.3 (Error scaled by 1.3)

 **$f_1(1420)$ DECAY MODES**

NODE=M006215;NODE=M006

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K} \pi$	seen
Γ_2 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_3 $\eta \pi \pi$	possibly seen
Γ_4 $a_0(980) \pi$	
Γ_5 $\pi \pi \rho$	
Γ_6 4π	
Γ_7 $\rho^0 \gamma$	
Γ_8 $\phi \gamma$	seen

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=4
 DESIG=3
 DESIG=6
 DESIG=8
 DESIG=9;OUR EST;→ UNCHECKED ←

 $f_1(1420) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M006220

 $\Gamma(K \bar{K} \pi) \times \Gamma(\gamma\gamma^*) / \Gamma_{\text{total}}$

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.9 ± 0.4 OUR AVERAGE					
3.2 ± 0.6 ± 0.7		133	9,10 ACHARD	07 L3	183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
3.0 ± 0.9 ± 0.7			11,12 BEHREND	89 CELL	$e^+ e^- \rightarrow e^+ e^- K_S^0 K \pi$
2.3 $^{+1.0}_{-0.9}$ ± 0.8			HILL	89 JADE	$e^+ e^- \rightarrow e^+ e^- K^\pm K_S^0 \pi^\mp$
1.3 ± 0.5 ± 0.3			AIHARA	88B TPC	$e^+ e^- \rightarrow e^+ e^- K^\pm K_S^0 \pi^\mp$
1.6 ± 0.7 ± 0.3			11,13 GIDAL	87B MRK2	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$
<8.0	95		JENNI	83 MRK2	$e^+ e^- \rightarrow e^+ e^- K \bar{K} \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

⁹ From a fit with a width fixed at 55 MeV.

¹⁰ The form factor parameter from the fit is 926 ± 78 MeV.

¹¹ Assume a ρ -pole form factor.

¹² A ϕ -pole form factor gives considerably smaller widths.

¹³ Published value divided by 2.

NODE=M006G2;LINKAGE=CH
 NODE=M006G2;LINKAGE=CR
 NODE=M006G2;LINKAGE=A
 NODE=M006G2;LINKAGE=D
 NODE=M006G2;LINKAGE=B

$f_1(1420)$ BRANCHING RATIOS

$\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K}\pi)$

Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.76 ± 0.06	BROMBERG	80	SPEC $100 \pi^- p \rightarrow K\bar{K}\pi X$
0.86 ± 0.12	DIONISI	80	HBC $4 \pi^- p \rightarrow K\bar{K}\pi n$

NODE=M006225

NODE=M006R1
 NODE=M006R1

$\Gamma(\pi\pi\rho)/\Gamma(K\bar{K}\pi)$

Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	95	CORDEN	78	OMEG $12-15 \pi^- p$
<2.0		DAHL	67	HBC $1.6-4.2 \pi^- p$

NODE=M006R2
 NODE=M006R2

$\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$

Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	ARMSTRONG	91B	OMEG $300 p p \rightarrow p p \eta \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35 ± 0.75		KOPKE	89	MRK3 $J/\psi \rightarrow \omega \eta \pi \pi (K\bar{K}\pi)$
<0.6	90	GIDAL	87	MRK2 $e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
<0.5	95	CORDEN	78	OMEG $12-15 \pi^- p$
1.5 ± 0.8		DEFOIX	72	HBC $0.7 \bar{p} p \rightarrow 7\pi$

NODE=M006R3
 NODE=M006R3

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$

Γ_4/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
>0.1	90	PROKOSHKIN	97B	GAM4 $100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
not seen in either mode		ANDO	86	SPEC $8 \pi^- p$
not seen in either mode		CORDEN	78	OMEG $12-15 \pi^- p$
0.4 ± 0.2		DEFOIX	72	HBC $0.7 \bar{p} p \rightarrow 7\pi$

NODE=M006R4
 NODE=M006R4

$\Gamma(4\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$

Γ_6/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.90	95	DIONISI	80	HBC $4 \pi^- p$

NODE=M006R5
 NODE=M006R5

$\Gamma(K\bar{K}\pi)/[\Gamma(K\bar{K}^*(892)+c.c.) + \Gamma(a_0(980)\pi)]$

$\Gamma_1/(\Gamma_2+\Gamma_4)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.65 ± 0.27	¹⁴ DIONISI	80	HBC $4 \pi^- p$

NODE=M006R6
 NODE=M006R6

¹⁴ Calculated using $\Gamma(K\bar{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.

NODE=M006R6;LINKAGE=C

$\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$

Γ_4/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.042 ± 0.014 OUR AVERAGE				
0.44 ± 0.19		ABLIKIM	21U	BES3 $D_s^+ \rightarrow f_1(1420)\pi^+$
$0.04 \pm 0.01 \pm 0.01$		BARBERIS	98C	OMEG $450 p p \rightarrow p_f f_1(1420) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.04	68	ARMSTRONG	84	OMEG $85 \pi^+ p$

NODE=M006R7
 NODE=M006R7

$\Gamma(4\pi)/\Gamma(K\bar{K}\pi)$

Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.62	95	ARMSTRONG	89G	OMEG $85 \pi p \rightarrow 4\pi X$

NODE=M006R8
 NODE=M006R8

$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$

Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.08	95	¹⁵ ARMSTRONG	92C	SPEC $300 p p \rightarrow p p \pi^+ \pi^- \gamma$

NODE=M006R9
 NODE=M006R9

¹⁵ Using the data on the $\bar{K}K\pi$ mode from ARMSTRONG 89.

NODE=M006R9;LINKAGE=A

$\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.02	95	BARBERIS	98C	OMEG 450 $p\bar{p} \rightarrow p_f f_1(1420) p_S$

 Γ_7/Γ_1

NODE=M006R10
 NODE=M006R10

 $\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.003±0.001±0.001	BARBERIS	98C	OMEG 450 $p\bar{p} \rightarrow p_f f_1(1420) p_S$

 Γ_8/Γ_1

NODE=M006R11
 NODE=M006R11

 $f_1(1420)$ REFERENCES

NODE=M006

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62055
ABLIKIM	21U	PR D104 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61155
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
SOSA	99	PRL 83 913	M. Sosa <i>et al.</i>		REFID=46937
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
PROKOSHKIN	97B	PD 42 298	Yu.D. Prokoshkin, S.A. Sadovsky		REFID=45549
Translated from DANS 354 751.					
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
ARMSTRONG	92E	ZPHY C56 29	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JPC	REFID=43173
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+) JPC	REFID=40729
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
HILL	89	ZPHY C42 355	P. Hill <i>et al.</i>	(JADE Collab.) JP	REFID=40741
KOPKE	89	PRPL 174 67	L. Kopke <i>et al.</i>	(CERN)	REFID=41863
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.) JP	REFID=40015
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
GIDAL	87B	PRL 59 2016	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40224
AIHARA	86C	PRL 57 2500	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.) JP	REFID=21326
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+)	REFID=20891
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=20929
BITYUKOV	84	SJNP 39 735	S. Bityukov <i>et al.</i>	(SERP)	REFID=45856
Translated from YAF 39 1165.					
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
JENNI	83	PR D27 1031	P. Jenni <i>et al.</i>	(SLAC, LBL)	REFID=20304
BROMBERG	80	PR D22 1513	C.M. Bromberg <i>et al.</i>	(CIT, FNAL, ILLC+)	REFID=20922
DIONISI	80	NP B169 1	C. Dionisi <i>et al.</i>	(CERN, MADR, CDEF+) IJP	REFID=20924
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20452
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321
Also		PRL 14 1074	D.H. Miller <i>et al.</i>	(LRL, UCB)	REFID=21291

$\omega(1420)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

See also the $\omega(1650)$ particle listing.

NODE=M125

NODE=M125

NODE=M125M

NODE=M125M

→ UNCHECKED ←

 $\omega(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1410± 60 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1418± 30± 10	824	¹ AKHMETSHIN 17A	CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
1470± 50	13.1k	² AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1382± 23± 70		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1350± 20± 20		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1400± 50± 130	1.2M	³ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1450± 10		⁴ HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1373± 70	177	⁵ AKHMETSHIN 00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
1370± 25	5095	ANISOVICH 00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
1400 ⁺¹⁰⁰ _{–200}		⁶ ACHASOV 98H	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
~ 1400		⁷ ACHASOV 98H	RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
~ 1460		⁸ ACHASOV 98H	RVUE	$e^+e^- \rightarrow K^+K^-$
1440± 70		⁹ CLEGG 94	RVUE	
1419± 31	315	¹⁰ ANTONELLI 92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$
¹ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.				
² From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.				
³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.				
⁴ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.				
⁵ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.				
⁶ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.				
⁷ Using the data from ANTONELLI 92.				
⁸ Using the data from IVANOV 81 and BISELLO 88B.				
⁹ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.				
¹⁰ From a fit to two Breit-Wigner functions interfering between them and with the ω,ϕ tails with fixed (+,–,+) phases.				

OCCUR=2

OCCUR=3

NODE=M125M;LINKAGE=F

NODE=M125M;LINKAGE=E

NODE=M125M;LINKAGE=VH

NODE=M125M;LINKAGE=AB

NODE=M125M;LINKAGE=KL

NODE=M125M;LINKAGE=L1

NODE=M125M;LINKAGE=L2

NODE=M125M;LINKAGE=L3

NODE=M125M;LINKAGE=AD

NODE=M125M;LINKAGE=B

 $\omega(1420)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
290±190 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
440±125	267	¹ ACHASOV 20B	SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
104± 35± 10	824	² AKHMETSHIN 17A	CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
880±170	13.1k	³ AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
480±180		⁴ ACHASOV 10D	SND	1.075–2.0 $e^+e^- \rightarrow \pi^0\gamma$
130± 50± 100		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
450± 70± 70		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
870 ⁺⁵⁰⁰ _{–300} ±450	1.2M	⁵ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199± 15		⁶ HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188± 45	177	⁷ AKHMETSHIN 00D	CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
360 ⁺¹⁰⁰ _{–60}	5095	ANISOVICH 00H	SPEC	0.0 $\rho\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
240± 70		⁸ CLEGG 94	RVUE	
174± 59	315	⁹ ANTONELLI 92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi$

NODE=M125W

NODE=M125W

→ UNCHECKED ←

- ¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV.
- ² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.
- ³ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.
- ⁴ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.
- ⁵ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ⁶ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ⁷ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.
- ⁸ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ⁹ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.

$\omega(1420)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	
Γ_4 $b_1(1235)\pi$	seen
Γ_5 e^+e^-	seen
Γ_6 $\pi^0\gamma$	

$\omega(1420)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

$$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.73 ± 0.08	13.1k	¹ AULCHENKO	15A	SND $1.05-1.80 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
$0.82 \pm 0.05 \pm 0.06$		AUBERT, B	04N	BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
$0.65 \pm 0.13 \pm 0.21$	1.2M	^{2,3} ACHASOV	03D	RVUE $0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.625 ± 0.160		^{4,5} CLEGG	94	RVUE
0.466 ± 0.178		^{6,7} ANTONELLI	92	DM2 $1.34-2.4 e^+e^- \rightarrow \rho\pi$

- ¹ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.
- ² Calculated by us from the cross section at the peak.
- ³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.
- ⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ⁵ From the partial and leptonic width given by the authors.
- ⁶ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.
- ⁷ From the product of the leptonic width and partial branching ratio given by the authors.

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
19.7 ± 5.7	AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1.9 ± 1.9	¹ AKHMETSHIN 00D	CMD2	$1.2-2.4 e^+e^- \rightarrow \omega\pi^+\pi^-$

- ¹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

NODE=M125W;LINKAGE=H

NODE=M125W;LINKAGE=F

NODE=M125W;LINKAGE=E

NODE=M125W;LINKAGE=G

NODE=M125W;LINKAGE=VH

NODE=M125W;LINKAGE=AB

NODE=M125W;LINKAGE=KL

NODE=M125W;LINKAGE=AD

NODE=M125W;LINKAGE=B

NODE=M125215;NODE=M125

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=6

NODE=M125230

NODE=M125G3
NODE=M125G3

NODE=M125G3;LINKAGE=A

NODE=M125G;LINKAGE=AW

NODE=M125G;LINKAGE=VH

NODE=M125G;LINKAGE=AD

NODE=M125G;LINKAGE=SE

NODE=M125G;LINKAGE=A

NODE=M125G;LINKAGE=ES

NODE=M125G4
NODE=M125G4

NODE=M125G;LINKAGE=KL

$$\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.5 ± 0.6	267	¹ ACHASOV	20B SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
$2.1^{+1.0}_{-0.8}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
$5.0 \pm 2.6 \pm 0.3$	824	² AKHMETSHIN	17A CMD3	$1.4-2.0 e^+e^- \rightarrow \omega\eta$
$1.6^{+0.9}_{-0.7}$	898	³ ACHASOV	16B SND	$1.34-2.00 e^+e^- \rightarrow \omega\eta$

¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in $(3.0 \pm 1.6) \times 10^{-8}$ measurement.

² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating. From an alternative fit $\Gamma(\omega(1420) \rightarrow \omega\eta)/\Gamma_{\text{total}} \times \Gamma(\omega(1420) \rightarrow e^+e^-) = 5.3 \pm 1.6$ eV.

³ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass and the width of $\omega(1420)$ are fixed to the 2014 edition (PDG 14) of this review.

NODE=M125G6;LINKAGE=C

NODE=M125G6;LINKAGE=B

NODE=M125G6;LINKAGE=A

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.23 ± 0.14	¹ ACHASOV	10D SND	$1.075-2.0 e^+e^- \rightarrow \pi^0\gamma$
$2.03^{+0.70}_{-0.75}$	² AKHMETSHIN	05 CMD2	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

² Using 1420 MeV and 220 MeV for the $\omega(1420)$ mass and width.

NODE=M125G5;LINKAGE=A

NODE=M125G5;LINKAGE=AK

$\omega(1420)$ BRANCHING RATIOS

NODE=M125225

$$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$$

$$\Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.301 ± 0.029	¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
possibly seen	AKHMETSHIN	00D CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$

NODE=M125R2
NODE=M125R2

$$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$$

$$\Gamma_2/\Gamma_4$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.60 ± 0.16	5095	ANISOVICH	00H SPEC	$0.0 p\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$

NODE=M125R1
NODE=M125R1

$$\Gamma(\rho\pi)/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	ACHASOV	20A SND	$1.15-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.699 ± 0.029	¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R3
NODE=M125R3

$$\Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 6.6	1.2M	^{2,3} ACHASOV	03D RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
23 ± 1		¹ HENNER	02 RVUE	$1.2-2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R4
NODE=M125R4

¹ Assuming that the $\omega(1420)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

² Calculated by us from the cross section at the peak.

³ Assuming that the $\omega(1420)$ decays into $\rho\pi$ only.

NODE=M125R;LINKAGE=AC
NODE=M125R;LINKAGE=AW
NODE=M125R;LINKAGE=GS

$\omega(1420)$ REFERENCES

ACHASOV	20A	EPJ C80 993	M.N. Achasov <i>et al.</i>	(SND Collab.)
ACHASOV	20B	EPJ C80 1008	M.N. Achasov <i>et al.</i>	(SND Collab.)
ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND Collab.)
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)
AKHMETSHIN	17A	PL B773 150	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
ACHASOV	16B	PR D94 092002	M.N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	15A	JETP 121 27	V.M. Aulchenko <i>et al.</i>	(SND Collab.)
		Translated from ZETF 148 34.		
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>	
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ANISOVICH	00H	PL B485 341	A.V. Anisovich <i>et al.</i>	
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
		Translated from ZETFP 46 132.		
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)

NODE=M125

REFID=60923
REFID=60924
REFID=59887
REFID=59304
REFID=58239
REFID=57537
REFID=56843

REFID=55687
REFID=59494
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REFID=47391
REFID=46323
REFID=44081
REFID=43168
REFID=41369
REFID=40581
REFID=40280

REFID=21586
REFID=20553

NODE=M066

 $f_2(1430)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry lists nearby peaks observed in the D wave of the $K\bar{K}$ and $\pi^+\pi^-$ systems. Needs confirmation.

NODE=M066

 $f_2(1430)$ MASS

NODE=M066M1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

 ≈ 1430 OUR ESTIMATE

NODE=M066M1

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1440 \pm 11 \pm 3$	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
1453 ± 4	¹ VLADIMIRSK...	01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1421 ± 5	AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1480 ± 50	AKESSON	86	SPEC	$pp \rightarrow pp \pi^+ \pi^-$
1436^{+26}_{-16}	DAUM	84	CNTR	$17-18 \pi^- p \rightarrow K^+ K^- n$
1412 ± 3	DAUM	84	CNTR	$63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
1439^{+5}_{-6}	² BEUSCH	67	OSPK	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$

OCCUR=2

¹ $J^{PC} = 0^{++}$ or 2^{++} .

² Not seen by WETZEL 76.

NODE=M066M;LINKAGE=AC
NODE=M066M;LINKAGE=C

 $f_2(1430)$ WIDTH

NODE=M066W1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$46 \pm 15 \pm 5$	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
13 ± 5	³ VLADIMIRSK...	01	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
30 ± 9	AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
150 ± 50	AKESSON	86	SPEC	$pp \rightarrow pp \pi^+ \pi^-$
81^{+56}_{-29}	DAUM	84	CNTR	$17-18 \pi^- p \rightarrow K^+ K^- n$
14 ± 6	DAUM	84	CNTR	$63 \pi^- p \rightarrow K_S^0 K_S^0 n, K^+ K^- n$
43^{+17}_{-18}	⁴ BEUSCH	67	OSPK	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$

OCCUR=2

³ $J^{PC} = 0^{++}$ or 2^{++} .

⁴ Not seen by WETZEL 76.

NODE=M066W;LINKAGE=AC
NODE=M066W;LINKAGE=C

$f_2(1430)$ DECAY MODES

NODE=M066215;NODE=M066

Mode	
Γ_1	$K\bar{K}$
Γ_2	$\pi\pi$

DESIG=1

DESIG=2

 $f_2(1430)$ REFERENCES

LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
VLADIMIRSK...	01	PAN 64 1895	V.V. Vladimisky <i>et al.</i>	
		Translated from YAF 64 1979.		
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
AKESSON	86	NP B264 154	T. Akesson <i>et al.</i>	(Axial Field Spec. Collab.)
DAUM	84	ZPHY C23 339	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)
BEUSCH	67	PL 25B 357	W. Beusch <i>et al.</i>	(ETH, CERN)

NODE=M066

REFID=61442

REFID=48571

REFID=40268

REFID=21123

REFID=21372

REFID=20362

REFID=20320

NODE=M149

 $a_0(1450)$

$$I^G(J^{PC}) = 1^-(0^+ +)$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M149

 $a_0(1450)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M149PP

NODE=M149PP

NODE=M149PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1290–1500) – i (30–140) OUR ESTIMATE			
$(1302.1 \pm 1.1 \pm 3.9) - i$ (56.2 $\pm$ 0.7 $\pm$ 1.7)	¹ ALBRECHT	20 RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1515 \pm 30) - i$ (115 $\pm$ 18)	ANISOVICH	09 RVUE	$0.0 \bar{p}p, \pi N$
$(1432 \pm 13 \pm 25) - i$ (98 $\pm$ 5 $\pm$ 5)	² BUGG	08A RVUE	$\bar{p}p$
$(1441^{+40}_{-15}) - i$ (55 $\pm$ 7)	³ BAKER	03 SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
$(1303 \pm 16) - i$ (46 $\pm$ 8)	⁴ BARGIOTTI	03 OBLX	$\bar{p}p$
$(1296 \pm 10) - i$ (41 $\pm$ 11)	AMSLER	02 CBAR	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$(1565 \pm 30) - i$ (146 $\pm$ 20)	ANISOVICH	98B RVUE	Compilation
$(1470 \pm 25) - i$ (132 $\pm$ 15)	⁵ AMSLER	95D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta \eta, \pi^0 \pi^0 \eta$

¹ T-matrix pole, 2 poles, 2 channels ($\pi\eta, K\bar{K}$).² Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.³ From the pole position of a fitted Breit-Wigner amplitude.⁴ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁵ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

NODE=M149PP;LINKAGE=A

NODE=M149PP;LINKAGE=G

NODE=M149PP;LINKAGE=C

NODE=M149PP;LINKAGE=D

NODE=M149PP;LINKAGE=F

 $a_0(1450)$ MASS

NODE=M149M

NODE=M149M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1439 $\pm$ 34 OUR AVERAGE		Error includes scale factor of 1.8.		
1480 $\pm$ 30		ABELE	98 CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
1410 $\pm$ 25		ETKIN	82C MPS	$23 \pi^- p \rightarrow n 2 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1458 $\pm$ 14 $\pm$ 15	190k	¹ AAIJ	16N LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
$1316.8^{+0.7+24.7}_{-1.0-4.6}$		² UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
1477 $\pm$ 10	80k	³ UMAN	06 E835	$5.2 \bar{p}p \rightarrow \eta \eta \pi^0$
1290 $\pm$ 10		⁴ BERTIN	98B OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
1450 $\pm$ 40		AMSLER	94D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
~ 1300		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 \pi p$
1255 $\pm$ 5		⁵ CASON	76	

- ¹ Using a model with Gaussian constraints to the PDG averaged values .
² May be a different state.
³ Statistical error only.
⁴ Not confirmed by BUGG 08A.
⁵ Isospin 0 not excluded.

NODE=M149M;LINKAGE=A
 NODE=M149M;LINKAGE=UE
 NODE=M149M;LINKAGE=ST
 NODE=M149M;LINKAGE=BE
 NODE=M149M;LINKAGE=CC

$a_0(1450)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
258 ± 14	OUR AVERAGE			
265 ± 15		ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
230 ± 30		ETKIN	82C MPS	23 $\pi^- p \rightarrow n 2K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
282 ± 12 ± 13	190k	¹ AAIJ	16N LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
65.0 ⁺ ₋ 2.1 ⁺ ₋ 99.1 ⁺ ₋ 5.4 ⁺ ₋ 32.6		² UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
267 ± 11	80k	³ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
80 ± 5		⁴ BERTIN	98B OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S^\pm \pi^\mp$
270 ± 40		AMSLER	94D CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
~ 250		MARTIN	78 SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
79 ± 10		⁵ CASON	76	

- ¹ Using a model with Gaussian constraints to the PDG averaged values .
² May be a different state.
³ Statistical error only.
⁴ Not confirmed by BUGG 08A.
⁵ Isospin 0 not excluded.

NODE=M149W

NODE=M149W

NODE=M149W;LINKAGE=A
 NODE=M149W;LINKAGE=UE
 NODE=M149W;LINKAGE=ST
 NODE=M149W;LINKAGE=BE
 NODE=M149W;LINKAGE=CC

$a_0(1450)$ DECAY MODES

Branching fractions are given relative to the one **DEFINED AS 1**.

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi \eta$	0.093 ± 0.020
Γ_2 $\pi \eta'(958)$	0.033 ± 0.017
Γ_3 $K \bar{K}$	0.082 ± 0.028
Γ_4 $\omega \pi \pi$	DEFINED AS 1
Γ_5 $a_0(980) \pi \pi$	seen
Γ_6 $\gamma \gamma$	seen

NODE=M149215;NODE=M149

NODE=M149

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$a_0(1450)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	$\Gamma_1 \Gamma_6 / \Gamma$
VALUE (eV)				
432 ± 6 ⁺ ₋ 1073 ⁺ ₋ 256	¹ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$	

- ¹ May be a different state.

NODE=M149225

NODE=M149G01
 NODE=M149G01

NODE=M149G01;LINKAGE=UE

$a_0(1450)$ BRANCHING RATIOS

$\Gamma(\pi\eta'(958))/\Gamma(\pi\eta)$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_1
VALUE				
0.35 ± 0.16	¹ ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.43 ± 0.19	ABELE	97C CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta'$	
¹ Using $\pi^0 \eta$ from AMSLER 94D.				
$\Gamma(K\bar{K})/\Gamma(\pi\eta)$	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
VALUE				
0.88 ± 0.23	¹ ABELE	98 CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.887 ± 0.041 ± 0.97	² ALBRECHT	20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$	

- ¹ Using $\pi^0 \eta$ from AMSLER 94D.
² Residues from T-matrix pole, 2 poles, 2 channels ($\pi \eta, K \bar{K}$).

NODE=M149220

NODE=M149R1
 NODE=M149R1

NODE=M149R1;LINKAGE=A

NODE=M149R2
 NODE=M149R2

NODE=M149R2;LINKAGE=A
 NODE=M149R2;LINKAGE=B

$\Gamma(\omega\pi\pi)/\Gamma(\pi\eta)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
10.7±2.3	35280	¹ BAKER	03 SPEC	$\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

¹ Using results on $\bar{p}p \rightarrow a_0(1450)^0\pi^0$, $a_0(1450) \rightarrow \eta\pi^0$ from ABELE 96C and assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

 Γ_4/Γ_1

NODE=M149R3
NODE=M149R3

NODE=M149R;LINKAGE=PP

 $\Gamma(a_0(980)\pi\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	BUGG	08A RVUE	$\bar{p}p$

 Γ_5/Γ

NODE=M149R01
NODE=M149R01

 $\Gamma(a_0(980)\pi\pi)/\Gamma(\pi\eta)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

≤ 4.3 ANISOVICH 01 RVUE 0 $\bar{p}p \rightarrow \eta 2\pi^+ 2\pi^-$

 Γ_5/Γ_1

NODE=M149R02
NODE=M149R02

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0\eta$

 Γ_6/Γ

NODE=M149R03
NODE=M149R03

¹ May be a different state.

NODE=M149R03;LINKAGE=UE

 $a_0(1450)$ REFERENCES

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>	
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97C	PL B404 179	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
ETKIN	82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)
CASON	76	PRL 36 1485	N.M. Cason <i>et al.</i>	(NDAM, ANL)

NODE=M149

REFID=60439
REFID=57273
REFID=52719
REFID=53002
REFID=52578
REFID=51063
REFID=49414
REFID=49217
REFID=48580
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REFID=45076
REFID=44377
REFID=44440
REFID=44441
REFID=44093
REFID=44078
REFID=20391
REFID=22446
REFID=21064

$\rho(1450)$

$$I^G(J^{PC}) = 1^+(1^--)$$

NODE=M105

 $\rho(1450)$ MASS

NODE=M105205

 $\rho(1450)$ MASS

VALUE (MeV)

DOCUMENT ID

1465±25 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

NODE=M105M0

NODE=M105M0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1506±11	13.4k	¹ GRIBANOV	20	CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1500±10	7.4k	² ACHASOV	18	SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1497±14		³ AKHMETSHIN 01B		CMD2	$e^+e^- \rightarrow \eta\gamma$
1421±15		⁴ AKHMETSHIN 00D		CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1470±20		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1446±10		FUKUI	88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

³ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

⁴ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105M1;LINKAGE=B

NODE=M105M1;LINKAGE=A

NODE=M105M;LINKAGE=SW

NODE=M105M1;LINKAGE=KL

 $\omega\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1510±7	10.2k	¹ ACHASOV	16D	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1544±22 ⁺¹¹ ₋₄₆	821	² MATVIENKO	15	BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
1491±19	7815	³ ACHASOV	13	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1582±17±25	2382	⁴ AKHMETSHIN 03B		CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1349±25 ⁺¹⁰ ₋₅	341	⁵ ALEXANDER	01B	CLE2	$B \rightarrow D^{(*)}\omega\pi^-$
1523±10		⁶ EDWARDS	00A	CLE2	$\tau^- \rightarrow \omega\pi^-\nu_\tau$
1463±25		⁷ CLEGG	94	RVUE	
1250		⁸ ASTON	80C	OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$
1290±40		⁸ BARBER	80C	SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

³ From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

⁴ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁵ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁶ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁷ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁸ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105M3;LINKAGE=D

NODE=M105M3;LINKAGE=C

NODE=M105M3;LINKAGE=AC

NODE=M105M3;LINKAGE=HK

NODE=M105M3;LINKAGE=3Z

NODE=M105M;LINKAGE=E1

NODE=M105M3;LINKAGE=B

NODE=M105M3;LINKAGE=A

 4π MODE

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1435±40		ABELE	01B	CBAR	0.0 $\bar{p}n \rightarrow 2\pi^-2\pi^0\pi^+$
1350±50		ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1449±4		¹ ARMSTRONG	89E	OMEG	300 $pp \rightarrow pp2(\pi^+\pi^-)$

¹ Not clear whether this observation has $I=1$ or 0.

NODE=M105M6

NODE=M105M6

NODE=M105M6;LINKAGE=A

$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1326.35 ± 3.46		¹ BARTOS 17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1342.31 ± 46.62		² BARTOS 17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1373.83 ± 11.37		³ BARTOS 17A	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1429 ± 41	20k	⁴ LEES 17C	BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
1350 ± 20	$+20$ -30 63.5k	⁵ ABRAMOWICZ 12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
1493 ± 15		⁶ LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
1446 ± 7	± 28 5.4M	^{7,8} FUJIKAWA 08	BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1328 ± 15		⁹ SCHAELE 05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
1406 ± 15	87k	^{7,10} ANDERSON 00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
~ 1368		¹¹ ABELE 99C	CBAR	$0.0 \bar{p}d \rightarrow \pi^+\pi^-\pi^-p$
1348 ± 33		BERTIN 98	OBLX	$0.05-0.405 \bar{n}p \rightarrow$ $2\pi^+\pi^-$
1411 ± 14		¹² ABELE 97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1370 $+90$ -70		ACHASOV 97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1359 ± 40		¹⁰ BERTIN 97C	OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1282 ± 37		BERTIN 97D	OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
1424 ± 25		BISELLO 89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1265.5 ± 75.3		DUBNICKA 89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1292 ± 17		¹³ KURDADZE 83	OLYA	$0.64-1.4 e^+e^- \rightarrow$ $\pi^+\pi^-$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of FUJIKAWA 08.

⁴ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.

⁵ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

⁶ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁷ From the GOUNARIS 68 parametrization of the pion form factor.

⁸ $|F_\pi(0)|^2$ fixed to 1.

⁹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAELE 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.

¹⁰ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

¹¹ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

¹² T-matrix pole.

¹³ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105M5
NODE=M105M5

OCCUR=2

OCCUR=2

NODE=M105M5;LINKAGE=D

NODE=M105M5;LINKAGE=E

NODE=M105M5;LINKAGE=F

NODE=M105M5;LINKAGE=B

NODE=M105M5;LINKAGE=AB

NODE=M105M5;LINKAGE=LE

NODE=M105M5;LINKAGE=1K

NODE=M105M5;LINKAGE=FU

NODE=M105M5;LINKAGE=SC

NODE=M105M5;LINKAGE=A

NODE=M105M5;LINKAGE=C5

NODE=M105M5;LINKAGE=QQ

NODE=M105M5;LINKAGE=KD

NODE=M105M7
NODE=M105M7

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1208 ± 8 ± 9	190k	¹ AAJ 16N	LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1422.8 ± 6.5	27k	² ABELE 99D	CBAR	±	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Using the GOUNARIS 68 parameterization with fixed width.

² K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105M7;LINKAGE=A

NODE=M105M7;LINKAGE=AN

 $K\bar{K}^*(892) + c.c.$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1505 ± 19 ± 7	AUBERT 08S	BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105M8
NODE=M105M8

 $m_{\rho(1450)^0} - m_{\rho(1450)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-31.53 ± 47.99	¹ BARTOS 17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M105DM
NODE=M105DM

NODE=M105DM;LINKAGE=A

$\rho(1450)$ WIDTH **$\rho(1450)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
400 ± 60 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.		

• • • We do not use the following data for averages, fits, limits, etc. • • •

480 ± 180 ¹ ACHASOV 10D SND 1.075–2.0 $e^+e^- \rightarrow \pi^0 \gamma$

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

NODE=M105210

NODE=M105W0
NODE=M105W0

→ UNCHECKED ←

NODE=M105W0;LINKAGE=A

 $\eta\rho^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
321 ± 27	13.4k	¹ GRIBANOV 20 CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$	
280 ± 20	7.4k	² ACHASOV 18 SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$	
226 ± 44		³ AKHMETSHIN 01B CMD2	$e^+e^- \rightarrow \eta\gamma$	
211 ± 31		⁴ AKHMETSHIN 00D CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$	
230 ± 30		ANTONELLI 88 DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$	
60 ± 15		FUKUI 88 SPEC	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$	

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

³ Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$.

⁴ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.

NODE=M105W1
NODE=M105W1

NODE=M105W1;LINKAGE=B

NODE=M105W1;LINKAGE=A

NODE=M105W;LINKAGE=SW

NODE=M105W1;LINKAGE=KL

 $\omega\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
440 ± 40	10.2k	¹ ACHASOV 16D SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$	
303 ⁺ _{–52} ³¹ _{–7}	821	² MATVIENKO 15 BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$	
429 ± 42 ± 10	2382	³ AKHMETSHIN 03B CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$	
547 ± 86 ⁺ _{–45}	341	⁴ ALEXANDER 01B CLE2	$B \rightarrow D^{(*)}\omega\pi^-$	
400 ± 35		⁵ EDWARDS 00A CLE2	$\tau^- \rightarrow \omega\pi^- \nu_\tau$	
311 ± 62		⁶ CLEGG 94 RVUE		
300		⁷ ASTON 80C OMEG	20–70 $\gamma p \rightarrow \omega\pi^0 p$	
320 ± 100		⁷ BARBER 80C SPEC	3–5 $\gamma p \rightarrow \omega\pi^0 p$	

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

² Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.

³ Using the data of AKHMETSHIN 03B and BISELLO 91B assuming the $\omega\pi^0$ and $\pi^+\pi^-$ mass dependence of the total width. $\rho(1700)$ mass and width fixed at 1700 MeV and 240 MeV, respectively.

⁴ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming the $\omega\pi^-$ mass dependence for the total width.

⁵ Mass-independent width parameterization. $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV respectively.

⁶ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

⁷ Not separated from $b_1(1235)$, not pure $J^P = 1^-$ effect.

NODE=M105W3
NODE=M105W3

OCCUR=3

NODE=M105W3;LINKAGE=D

NODE=M105W3;LINKAGE=C

NODE=M105W3;LINKAGE=HK

NODE=M105W3;LINKAGE=3Z

NODE=M105W;LINKAGE=E1

NODE=M105W3;LINKAGE=B

NODE=M105W3;LINKAGE=A

 4π MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
325 ± 100	ABELE 01B CBAR	0.0 $\bar{p}n \rightarrow 2\pi^- 2\pi^0 \pi^+$	

NODE=M105W66
NODE=M105W66

$\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
324.13 ± 12.01		¹ BARTOS	17 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
492.17 ± 138.38		² BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
340.87 ± 23.84		³ BARTOS	17A RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
576 ± 29	20k	⁴ LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
460 ± 30	$\begin{smallmatrix} +40 \\ -45 \end{smallmatrix}$ 63.5k	⁵ ABRAMOWICZ12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
427 ± 31		⁶ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
434 ± 16	± 60 5.4M	^{7,8} FUJIKAWA	08 BELL	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
468 ± 41		⁹ SCHAELE	05C ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
455 ± 41	87k	^{7,10} ANDERSON	00A CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
~ 374		¹¹ ABELE	99C CBAR	$0.0 \bar{p}d \rightarrow \pi^+\pi^-\pi^-p$
275 ± 10		BERTIN	98 OBLX	$0.05-0.405 \bar{n}p \rightarrow$ $\pi^+\pi^+\pi^-\pi^0$
343 ± 20		¹² ABELE	97 CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		¹⁰ BERTIN	97C OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
236 ± 36		BERTIN	97D OBLX	$0.05 \bar{p}p \rightarrow 2\pi^+2\pi^-$
269 ± 31		BISELLO	89 DM2	$e^+e^- \rightarrow \pi^+\pi^-$
391 ± 70		DUBNICKA	89 RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
218 ± 46		¹³ KURDADZE	83 OLYA	$0.64-1.4 e^+e^- \rightarrow$ $\pi^+\pi^-$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.

⁴ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.

⁵ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

⁶ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁷ From the GOUNARIS 68 parametrization of the pion form factor.

⁸ $|F_\pi(0)|^2$ fixed to 1.

⁹ From the combined fit of the τ^- data from ANDERSON 00A and SCHAELE 05C and e^+e^- data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. $\rho(1700)$ mass and width fixed at 1713 MeV and 235 MeV, respectively. Supersedes BARATE 97M.

¹⁰ $\rho(1700)$ mass and width fixed at 1700 MeV and 235 MeV, respectively.

¹¹ $\rho(1700)$ mass and width fixed at 1780 MeV and 275 MeV respectively.

¹² T-matrix pole.

¹³ Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.

NODE=M105W5
NODE=M105W5

OCCUR=2

NODE=M105W5;LINKAGE=C

NODE=M105W5;LINKAGE=D

NODE=M105W5;LINKAGE=E

NODE=M105W5;LINKAGE=B

NODE=M105W5;LINKAGE=AB

NODE=M105W5;LINKAGE=LE

NODE=M105W5;LINKAGE=1K

NODE=M105W5;LINKAGE=FU

NODE=M105W5;LINKAGE=SC

NODE=M105W5;LINKAGE=A

NODE=M105W5;LINKAGE=C5

NODE=M105W5;LINKAGE=QQ

NODE=M105W5;LINKAGE=KD

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
410 ± 19 ± 35	190k	¹ AAIJ	16N LHCb		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
146.5 ± 10.5	27k	² ABELE	99D CBAR	±	$0.0 \bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Using the GOUNARIS 68 parameterization with fixed mass.

² K-matrix pole. Isospin not determined, could be $\omega(1420)$.

NODE=M105W7;LINKAGE=A

NODE=M105W7;LINKAGE=AN

 $K\bar{K}^*(892) + \text{c.c.} \text{ MODE}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
418 ± 25 ± 4	AUBERT	08S BABR	$10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105W8
NODE=M105W8

 $\Gamma_{\rho(1450)^0} = \Gamma_{\rho(1450)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
151.30 ± 140.42	¹ BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M105DW
NODE=M105DW

NODE=M105DW;LINKAGE=A

$\rho(1450)$ DECAY MODES

NODE=M105215;NODE=M105

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	seen
$\Gamma_2 \quad \pi^+\pi^-$	seen
$\Gamma_3 \quad 4\pi$	seen
$\Gamma_4 \quad \omega\pi$	
$\Gamma_5 \quad a_1(1260)\pi$	
$\Gamma_6 \quad h_1(1170)\pi$	
$\Gamma_7 \quad \pi(1300)\pi$	
$\Gamma_8 \quad \rho\rho$	
$\Gamma_9 \quad \rho(\pi\pi)S\text{-wave}$	
$\Gamma_{10} \quad e^+e^-$	seen
$\Gamma_{11} \quad \eta\rho$	seen
$\Gamma_{12} \quad a_2(1320)\pi$	not seen
$\Gamma_{13} \quad K\bar{K}$	seen
$\Gamma_{14} \quad K^+K^-$	seen
$\Gamma_{15} \quad K\bar{K}^*(892) + \text{c.c.}$	possibly seen
$\Gamma_{16} \quad \pi^0\gamma$	seen
$\Gamma_{17} \quad \eta\gamma$	seen
$\Gamma_{18} \quad f_0(500)\gamma$	not seen
$\Gamma_{19} \quad f_0(980)\gamma$	not seen
$\Gamma_{20} \quad f_0(1370)\gamma$	not seen
$\Gamma_{21} \quad f_2(1270)\gamma$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=20;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=10
DESIG=11
DESIG=12
DESIG=13
DESIG=14
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=21;OUR EVAL;→ UNCHECKED ←
DESIG=15;OUR EST;→ UNCHECKED ←
DESIG=23;OUR EST;→ UNCHECKED ←
DESIG=9
DESIG=16;OUR EST;→ UNCHECKED ←
DESIG=17;OUR EST;→ UNCHECKED ←
DESIG=18;OUR EST;→ UNCHECKED ←
DESIG=19;OUR EST;→ UNCHECKED ←

 $\rho(1450) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M105220

 $\Gamma(\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_{10}/\Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.12	¹ DIEKMAN	88	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
$0.027^{+0.015}_{-0.010}$	² KURDADZE	83	OLYA $0.64\text{--}1.4 e^+e^- \rightarrow \pi^+\pi^-$

¹ Using total width = 235 MeV.² Using for $\rho(1700)$ mass and width 1600 ± 20 and 300 ± 10 MeV respectively.NODE=M105G3
NODE=M105G3NODE=M105G3;LINKAGE=B
NODE=M105G3;LINKAGE=KD **$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_{11}\Gamma_{10}/\Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$335 \pm 27 \pm 20$	13.4k	¹ GRIBANOV	20	CMD3 $1.1\text{--}2.0 e^+e^- \rightarrow \eta\pi^+\pi^-$
$210 \pm 24 \pm 10$		² LEES	18	BABR $e^+e^- \rightarrow \eta\pi^+\pi^-$
74 ± 20		³ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
91 ± 19		ANTONELLI	88	DM2 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.² Includes non-resonant contribution. The selected fit model includes three ρ excited states. Model uncertainty is 20%.³ Using the data of ANTONELLI 88, DOLINSKY 91, and AKHMETSHIN 00D. The energy-independent width of the $\rho(1450)$ and $\rho(1700)$ mesons assumed.NODE=M105G4
NODE=M105G4

NODE=M105G4;LINKAGE=B

NODE=M105G4;LINKAGE=A

NODE=M105G4;LINKAGE=KL

 $\Gamma(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_{15}\Gamma_{10}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$127 \pm 15 \pm 6$	AUBERT	08S	BABR $10.6 e^+e^- \rightarrow K\bar{K}^*(892)\gamma$

NODE=M105G8
NODE=M105G8 **$\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_{17}\Gamma_{10}/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16.4	¹ AKHMETSHIN 05	CMD2	$0.60\text{--}1.38 e^+e^- \rightarrow \eta\gamma$
$2.2 \pm 0.5 \pm 0.3$	² AKHMETSHIN 01B	CMD2	$e^+e^- \rightarrow \eta\gamma$

¹ From 2γ decay mode of η using 1465 MeV and 310 MeV for the $\rho(1450)$ mass and width. Recalculated by us.² Using the data of AKHMETSHIN 01B on $e^+e^- \rightarrow \eta\gamma$, AKHMETSHIN 00D and ANTONELLI 88 on $e^+e^- \rightarrow \eta\pi^+\pi^-$. Recalculated by us using width of 226 MeV.NODE=M105G6
NODE=M105G6

NODE=M105G6;LINKAGE=AK

NODE=M105G;LINKAGE=SW

$\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M105230

 $\Gamma(\omega\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R05
NODE=M105R05

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.1 ± 0.4	10.2k	¹ ACHASOV	16D	SND	$1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
5.3 ± 0.4	7815	² ACHASOV	13	SND	$1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$

OCCUR=3

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(770)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainties not estimated. Supersedes ACHASOV 13.

NODE=M105R05;LINKAGE=A

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M105R05;LINKAGE=AC

 $\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{11}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R00
NODE=M105R00

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.3 ± 0.3	7.4k	¹ ACHASOV	18	SND	$1.22-2.00 e^+e^- \rightarrow \eta\pi^+\pi^-$
$4.3^{+1.1}_{-0.9} \pm 0.2$	4.9k	² AULCHENKO	15	SND	$1.22-2.00 e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M105R00;LINKAGE=B

² From a fit to the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta\rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R00;LINKAGE=A

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{16}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R17
NODE=M105R17

VALUE (units 10^{-9})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ± 1.4	¹ ACHASOV	10D	SND	$1.075-2.0 e^+e^- \rightarrow \pi^0\gamma$

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. Systematic errors not evaluated.

NODE=M105R17;LINKAGE=A

 $\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{18}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R01
NODE=M105R01

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT

<4.0	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

 $\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R02
NODE=M105R02

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT

<2.6	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

 $\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{20}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R03
NODE=M105R03

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT

<3.5	90	ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

 $\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{21}/\Gamma \times \Gamma_{10}/\Gamma$ NODE=M105R04
NODE=M105R04

VALUE (units 10^{-9})	CL%	DOCUMENT ID	TECN	COMMENT

<0.8	90	¹ ACHASOV	11	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ Using Breit-Wigner parametrization of the $\rho(1450)$ with mass and width of 1465 MeV and 400 MeV, respectively.

NODE=M105R01;LINKAGE=AC

 $\rho(1450)$ BRANCHING RATIOS

NODE=M105225

 $\Gamma(\pi\pi)/\Gamma(4\pi)$ Γ_1/Γ_3 NODE=M105R15
NODE=M105R15

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.37 ± 0.10	^{1,2} ABELE	01B	CBAR $0.0 \bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

² Using ABLE 97.

NODE=M105R;LINKAGE=BL

NODE=M105R;LINKAGE=LK

$\Gamma(K^+K^-)/\Gamma(\pi^+\pi^-)$ Γ_{14}/Γ_2

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
30.7±8.4±8.2	20k	¹ LEES	17C	BABR $J/\psi \rightarrow h^+ h^- \pi^0$

¹ From Dalitz plot analyses in isobar models.NODE=M105R08
NODE=M105R08

NODE=M105R08;LINKAGE=A

 $\Gamma(\omega\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	821	¹ MATVIENKO	15	BELL $\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
seen	1.6k	ACHASOV	12	SND $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
~ 0.21		CLEGG	94	RVUE

¹ Using Breit-Wigner parameterization of the $\rho(1450)$ and assuming equal probabilities of the $\rho(1450) \rightarrow \pi\pi$ and $\rho(1450) \rightarrow \omega\pi$ decays.NODE=M105R5
NODE=M105R5

NODE=M105R5;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\omega\pi)$ Γ_1/Γ_4

VALUE	DOCUMENT ID	TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •		
~ 0.32	CLEGG	94 RVUE

NODE=M105R6
NODE=M105R6 $\Gamma(\omega\pi)/\Gamma(4\pi)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •		
<0.14	CLEGG	88 RVUE

NODE=M105R3
NODE=M105R3 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_5/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.27±0.08	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.NODE=M105R10
NODE=M105R10

NODE=M105R10;LINKAGE=BL

 $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ Γ_6/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08±0.04	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.NODE=M105R11
NODE=M105R11

NODE=M105R11;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_7/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.37±0.13	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.NODE=M105R12
NODE=M105R12

NODE=M105R12;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_8/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.11±0.05	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.NODE=M105R13
NODE=M105R13

NODE=M105R13;LINKAGE=BL

 $\Gamma(\rho(\pi\pi)\text{S-wave})/\Gamma(4\pi)$ Γ_9/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17±0.09	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.NODE=M105R14
NODE=M105R14

NODE=M105R14;LINKAGE=BL

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	35	¹ ACHASOV	14	SND 1.15–2.00 $e^+ e^- \rightarrow \eta\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.04		DONNACHIE	87B	RVUE

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.NODE=M105R2
NODE=M105R2

NODE=M105R2;LINKAGE=A

$\Gamma(\eta\rho)/\Gamma(\omega\pi)$ Γ_{11}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.081 ± 0.020	^{1,2} AULCHENKO	15	SND	$1.22-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$
~ 0.24	³ DONNACHIE	91	RVUE	
>2	FUKUI	91	SPEC	$8.95 \pi^- p \rightarrow \omega \pi^0 n$

¹ From a fit to the $\text{e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta \rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

² Reports the inverse of the quoted value as 12.3 ± 3.1 .

³ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R4
NODE=M105R4

NODE=M105R4;LINKAGE=A

NODE=M105R4;LINKAGE=B
NODE=M105R;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\eta\rho)$ Γ_1/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.3 ± 0.4	¹ AULCHENKO	15	SND	$1.22-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$

¹ From a fit to the $\text{e}^+ \text{e}^- \rightarrow \eta \pi^+ \pi^-$ cross section with vector meson dominance model including $\rho(770)$, $\rho(1450)$, and $\rho(1700)$ decaying exclusively via $\eta \rho(770)$. Masses and widths of vector states are fixed to PDG 14. Coupling constants are assumed to be real.

NODE=M105R07
NODE=M105R07

NODE=M105R07;LINKAGE=A

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AMELIN	00	VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M105R9
NODE=M105R9

 $\Gamma(K\bar{K})/\Gamma(\omega\pi)$ Γ_{13}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.08	¹ DONNACHIE	91	RVUE	

¹ Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R8
NODE=M105R8

NODE=M105R8;LINKAGE=A

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	COAN	04	CLEO	$\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

NODE=M105R16
NODE=M105R16

 $\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen	35	¹ ACHASOV	14	SND	$1.15-2.00 \text{ e}^+ \text{e}^- \rightarrow \eta \gamma$

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M105R06
NODE=M105R06

NODE=M105R06;LINKAGE=A

 $\rho(1450)$ REFERENCES

NODE=M105

GRIBANOV	20	JHEP 2001 112	S.S. Gribov <i>et al.</i>	(CMD-3 Collab.)	REFID=60620
ACHASOV	18	PR D97 012008	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=58785
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58900
BARTOS	17	PR D96 113004	E. Bartos <i>et al.</i>		REFID=58325
BARTOS	17A	IJMP A32 1750154	E. Bartos <i>et al.</i>		REFID=58367
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM	16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57138
ACHASOV	16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=57618
AULCHENKO	15	PR D91 052013	V.M. Aulchenko <i>et al.</i>	(SND Collab.)	REFID=56793
MATVIENKO	15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)	REFID=56601
ACHASOV	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55912
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG Collab.)	REFID=55687
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55584
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54274
ACHASOV	12	JETPL 94 734	M.N. Achasov <i>et al.</i>		REFID=54275
		Translated from ZETFP 94 796.			
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54299
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
ACHASOV	11	JETP 113 75	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=16721
		Translated from ZETF 140 87.			
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59494
DUBNICKA	10	APS 60 1	S. Dubnicka, A.Z. Dubnickova		REFID=58797
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)	REFID=52536
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51615
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETF 130 437.			

AKHMETSHIN	05	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)
SCHAEEL	05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH Collab.)
AKHMETSHIN	04	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ALEXANDER	01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE	99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
CLEGG	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
ASTON	80C	Translated from ZETFP 37 613.	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BARBER	80C	PL B2B 211	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

REFID=50330
 REFID=51112
 REFID=50845
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 REFID=49945
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 REFID=40273
 REFID=40418
 REFID=40920
 REFID=20246
 REFID=20134
 REFID=20133
 REFID=20652
 REFID=20653
 REFID=48054

NODE=M175

$\eta(1475)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

See the $\eta(1405)$ and the related review on "Spectroscopy of Light Meson Resonances."

NODE=M175

$\eta(1475)$ MASS

NODE=M175M5

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
1476 ± 4 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.
 [1475 ± 4 MeV OUR 2023 AVERAGE Scale factor = 1.4]

NODE=M175M5

NEW

1507.6 ± 1.6	$^{+15.5}_{-32.2}$	126K	¹ ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1469 ± 14	± 13	74	ACHARD	07	L3	$183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
1460 ± 12		3651	NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1485 ± 8	± 5	20k	ADAMS	01B	B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
1500 ± 10			CICALO	99	OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1464 ± 10			BERTIN	97	OBLX	$0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1460 ± 10			BERTIN	95	OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
1490 $^{+14}_{-8}$	$^{+3}_{-16}$	1100	BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1475 ± 4			RATH	89	MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1477 ± 7	± 13		² ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
1565 ± 8	$^{+0}_{-63}$		³ ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
1421 ± 14			AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

OCCUR=2

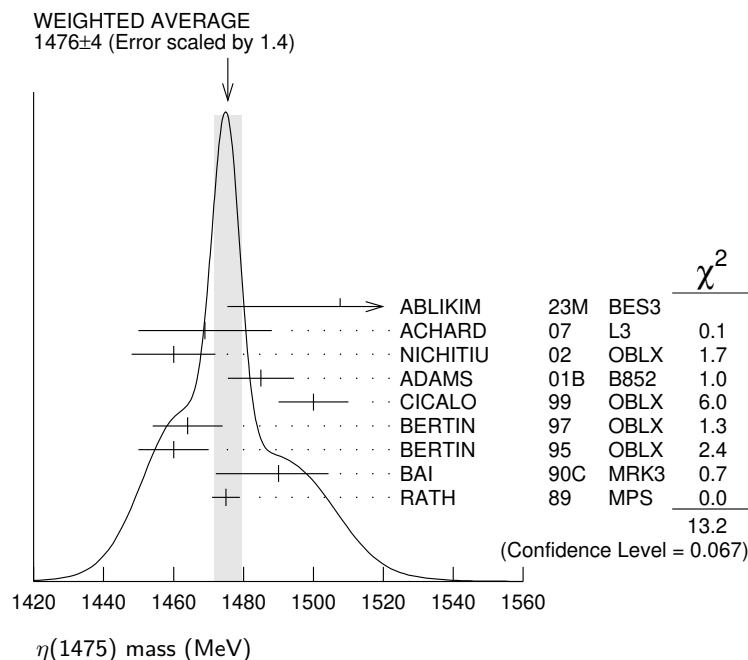
¹ ABLIKIM 23M reports for this state a significance from the fit much higher than 35σ .

² From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

³ Could also be the $\eta(1405)$.

NODE=M175M5;LINKAGE=C
NODE=M175M5;LINKAGE=B

NODE=M175M5;LINKAGE=A



$\eta(1475)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
96 ± 9 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
[90 ± 9 MeV OUR 2023 AVERAGE Scale factor = 1.6]				
115.8± 2.4 ^{+14.8} _{-10.9}	126K	ABLIKIM	23M BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
67 ± 18 ± 7	74	ACHARD	07 L3	$183\text{--}209 e^+ e^- \rightarrow e^+ e^- K_S^0 K^\pm \pi^\mp$
120 ± 15	3651	NICHITIU	02 OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
98 ± 18 ± 3	20k	ADAMS	01B B852	$18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$
100 ± 20		CICALO	99 OBLX	$0 \bar{p} p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	97 OBLX	$0.0 \bar{p} p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
105 ± 15		BERTIN	95 OBLX	$0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$
54 ⁺³⁷ ₋₂₁ ⁺¹³ ₋₂₄		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51 ± 13		RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
118 ± 22 ± 17		¹ ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
45 ⁺¹⁴ ₋₁₃ ⁺²¹ ₋₂₈		² ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
63 ± 18		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

¹ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

² Could also be the $\eta(1405)$.

NODE=M175W5

NODE=M175W5
NEW

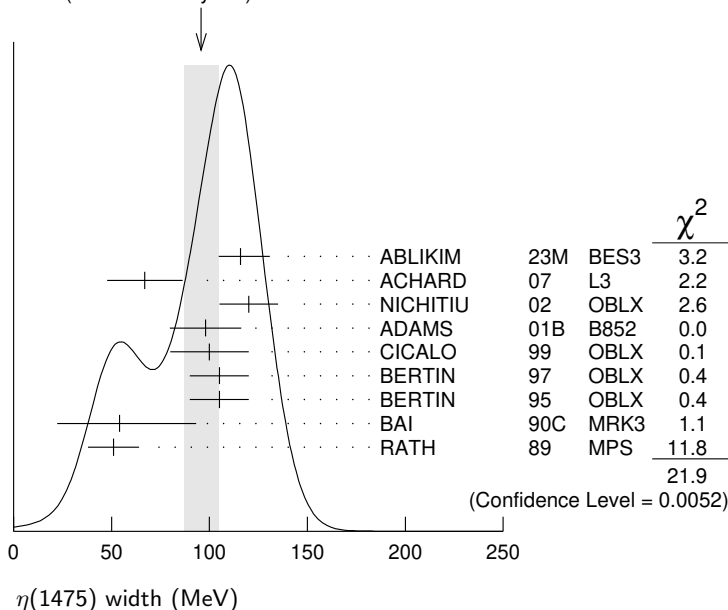
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OCCUR=2

OCCUR=2

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NODE=M175W5;LINKAGE=A

WEIGHTED AVERAGE
96±9 (Error scaled by 1.7)



$\eta(1475)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}\pi$	seen
Γ_2 $K\bar{K}^*(892) + \text{c.c.}$	seen
Γ_3 $a_0(980)\pi$	seen
Γ_4 $\gamma\gamma$	seen
Γ_5 $K_S^0 K_S^0 \eta$	possibly seen
Γ_6 $\gamma\phi(1020)$	possibly seen

NODE=M175215;NODE=M175

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←
DESIG=9

$\eta(1475)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_4/\Gamma$
VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.23±0.05±0.05		74	¹ ACHARD	07 L3	183-209 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.089	90		^{2,3} AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M175220

NODE=M175G2
NODE=M175G2

¹ Supersedes ACCIARRI 01G. Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895$.

² Using $\eta(1475)$ mass of 1481 MeV and width of 48 MeV. The upper limit increases to 0.140 keV if the world average value, 87 MeV, of the width is used.

³ Assuming three-body phase-space decay to $K_S^0 K^\pm \pi^\mp$.

NODE=M175G2;LINKAGE=CH
NODE=M175G2;LINKAGE=AH

NODE=M175G2;LINKAGE=B3

$\eta(1475)$ BRANCHING RATIOS

$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K\bar{K}\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT		
0.50±0.10	¹ BAILLON	67 HBC	0.0 $\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
¹ Data could also refer to $\eta(1405)$.					

NODE=M175225

NODE=M175R1
NODE=M175R1

NODE=M175R;LINKAGE=BL

$\Gamma(K\bar{K}^*(892) + \text{c.c.})/[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980)\pi)]$					$\Gamma_2/(\Gamma_2+\Gamma_3)$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	90	EDWARDS	82E CBAL	$J/\psi \rightarrow K^+K^-\pi^0\gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					

NODE=M175R6
NODE=M175R6

$\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$ Γ_4/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.27 \times 10^{-3}$	90	¹ ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma$

¹ Using results from BAI 00D.

NODE=M175R01
 NODE=M175R01

NODE=M175R01;LINKAGE=A

 $\Gamma(\gamma\phi(1020))/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	¹ ABLIKIM	181 BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$

¹ Seen as a peak in $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded. Also see $\eta(1405)$.

NODE=M175R00
 NODE=M175R00

NODE=M175R00;LINKAGE=A

 $\eta(1475)$ REFERENCES

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	181	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	180	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)

NODE=M175

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 REFID=20407

 $f_0(1500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M152

NODE=M152

 $f_0(1500)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M152PP

NODE=M152PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1430–1530) – i (40–90) OUR ESTIMATE			
$(1450 \pm 10) - i (53 \pm 8)$	¹ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1483 \pm 15) - i (58 \pm 6)$	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1496 \pm 1.2^{+4.4}_{-26.4}) - i (40.4 \pm 0.3^{+10.0}_{-2.5})$	² ALBRECHT	20 RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta\eta, \pi^0 K^+ K^-$
$(1465 \pm 18) - i (50 \pm 9)$	³ ROPERTZ	18 RVUE	$\bar{B}_s^0 \rightarrow J/\psi (\pi^+ \pi^- / K^+ K^-)$
$(1486 \pm 10) - i (57 \pm 5)$	ANISOVICH	09 RVUE	$0.0 \bar{p}p, \pi N$
$(1489^{+8}_{-4}) - i (51 \pm 5)$	⁴ ANISOVICH	03 RVUE	
$(1515 \pm 12) - i (55 \pm 12)$	BARBERIS	00A	$450 pp \rightarrow p_f (\eta\eta', \eta'\eta') p_s$
$(1511 \pm 9) - i (51 \pm 9)$	⁵ BARBERIS	00C	$450 pp \rightarrow p_f 4\pi p_s$
$(1510 \pm 8) - i (55 \pm 8)$	BARBERIS	00E	$450 pp \rightarrow p_f \eta\eta p_s$
$(1502 \pm 12 \pm 10) - i (49 \pm 9 \pm 8)$	⁶ BARBERIS	99D OMEG	$450 pp \rightarrow K^+ K^-, \pi^+ \pi^-$
$(1447 \pm 27) - i (54 \pm 23)$	⁷ KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$
$(1499 \pm 8) - i (65 \pm 10)$	ANISOVICH	98B RVUE	Compilation.
$(1510 \pm 20) - i (60 \pm 18)$	BARBERIS	97B OMEG	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
$(1449 \pm 20) - i (57 \pm 15)$	BERTIN	97C OBLX	$0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
$(1515 \pm 20) - i (53 \pm 8)$	ABELE	96B CBAR	$0.0 \bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
$(1500 \pm 8) - i (66 \pm 8)$	ABELE	96C RVUE	Compilation.
$(1500 \pm 10) - i (77 \pm 15)$	⁸ AMSLER	95D CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$
$(1520 \pm 25) - i (74^{+10}_{-13})$	⁹ ANISOVICH	94 CBAR	$0.0 \bar{p}p \rightarrow 3\pi^0, \pi^0 \eta\eta$
$(1505 \pm 20) - i (75 \pm 10)$	¹⁰ BUGG	94 RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0 \pi^0$

NODE=M152PP

→ UNCHECKED ←

- ¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
- ² T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).
- ³ T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.
- ⁴ Pole position from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K\bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- ⁵ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.
- ⁶ Supersedes BARBERIS 99 and BARBERIS 99B.
- ⁷ T-matrix pole on sheet $--+$.
- ⁸ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
- ⁹ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$.
- ¹⁰ Reanalysis of ANISOVICH 94 data.

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NODE=M152PP;LINKAGE=G

NODE=M152PP;LINKAGE=C

NODE=M152PP;LINKAGE=H

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NODE=M152PP;LINKAGE=J

NODE=M152PP;LINKAGE=K

 $f_0(1500)$ MASS

NODE=M152M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1522 ± 25		¹ BERTIN 98	OBLX	0.05–0.405 $\bar{p} p \rightarrow \pi^+ \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1492.5 ± 3.6 ⁺ _{−2.4} _{20.5}		² ABLIKIM 22G	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
1447 ± 16 ± 13	163	^{3,4} DOBBS 15		$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1442 ± 9 ± 4	261	^{3,4} DOBBS 15		$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
1460.9 ± 2.9		⁵ AAIJ 14BR	LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$
1468 ⁺ _{−15} ⁺ _{−74}	5.5k	⁶ ABLIKIM 13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1470 ± 60	568	⁷ KLEMPPT 08	E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
1470 ⁺ _{−7} ⁺ _{−255}		⁸ UEHARA 08A	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1466 ± 6 ± 20		⁹ ABLIKIM 06V	BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1495 ± 4		AMSLER 06	CBAR	0.9 $\bar{p} p \rightarrow K^+ K^- \pi^0$
1539 ± 20	9.9k	AUBERT 06O	BABR	$B^+ \rightarrow K^+ K^+ K^-$
1473 ± 5	80k	^{9,10} UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
1478 ± 6		VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1493 ± 7		⁹ BINON 05	GAMS	33 $\pi^- p \rightarrow \eta \eta n$
1524 ± 14	1400	¹¹ GARMASH 05	BELL	$B^+ \rightarrow K^+ K^+ K^-$
1490 ± 30		⁹ ABELE 01	CBAR	0.0 $\bar{p} d \rightarrow \pi^- 4\pi^0 p$
1497 ± 10		⁹ BARBERIS 99	OMEG	450 $pp \rightarrow p_s p_f K^+ K^-$
1502 ± 10		⁹ BARBERIS 99B	OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$
1530 ± 45		⁹ BELLAZZINI 99	GAM4	450 $pp \rightarrow pp \pi^0 \pi^0$
1505 ± 18		⁹ FRENCH 99		300 $pp \rightarrow p_f(K^+ K^-) p_s$
1580 ± 80		⁹ ALDE 98	GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
~ 1520		REYES 98	SPEC	800 $pp \rightarrow p_s p_f K_S^0 K_S^0$
~ 1475		FRABETTI 97D	E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 1505		ABELE 96	CBAR	0.0 $\bar{p} p \rightarrow 5\pi^0$
1460 ± 20	120	⁹ AMELIN 96B	VES	37 $\pi^- A \rightarrow \eta \eta \pi^- A$
1500 ± 8		BUGG 96	RVUE	
1500 ± 15		¹² AMSLER 95B	CBAR	0.0 $\bar{p} p \rightarrow 3\pi^0$
1505 ± 15		¹³ AMSLER 95C	CBAR	0.0 $\bar{p} p \rightarrow \eta \eta \pi^0$
1445 ± 5		¹⁴ ANTINORI 95	OMEG	300,450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1497 ± 30		⁹ ANTINORI 95	OMEG	300,450 $pp \rightarrow pp \pi^+ \pi^-$
~ 1505		BUGG 95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1446 ± 5		⁹ ABATZIS 94	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1545 ± 25		⁹ AMSLER 94E	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \eta \eta'$
1560 ± 25		⁹ AMSLER 92	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \eta \eta$
1550 ± 45 ± 30		⁹ BELADIDZE 92C	VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
1449 ± 4		⁹ ARMSTRONG 89E	OMEG	300 $pp \rightarrow pp2(\pi^+ \pi^-)$
1610 ± 20		⁹ ALDE 88	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$

NODE=M152M

OCCUR=2

OCCUR=2

OCCUR=2

~ 1525		ASTON	88D	LASS	11	$K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1570 ± 20	600	⁹ ALDE	87	GAM4	100	$\pi^- p \rightarrow 4\pi^0 n$
1575 ± 45		¹⁵ ALDE	86D	GAM4	100	$\pi^- p \rightarrow 2\eta n$
1568 ± 33		⁹ BINON	84C	GAM2	38	$\pi^- p \rightarrow \eta \eta' n$
1592 ± 25		⁹ BINON	83	GAM2	38	$\pi^- p \rightarrow 2\eta n$
1525 ± 5		⁹ GRAY	83	DBC	0.0	$\bar{p} N \rightarrow 3\pi$
¹ Breit-Wigner mass.						
² The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.						
³ Using CLEO-c data but not authored by the CLEO Collaboration.						
⁴ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 109$ MeV.						
⁵ Solution I, statistical error only.						
⁶ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.						
⁷ Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.						
⁸ Breit-Wigner mass. May also be the $f_0(1370)$.						
⁹ Breit-Wigner mass.						
¹⁰ Statistical error only.						
¹¹ Breit-Wigner, solution 1, PWA ambiguous.						
¹² T-matrix pole, supersedes ANISOVICH 94.						
¹³ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.						
¹⁴ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.						
¹⁵ From central value and spread of two solutions. Breit-Wigner mass.						

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$f_0(1500)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
108 ± 33		¹ BERTIN	98 OBLX	$0.05-0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
107 ± 9 ⁺ ₇		² ABLIKIM	22G BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
124 ± 7		³ AAIJ	14BR LHCb	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$
136 ⁺ ₂₆ 41 ⁺ ₂₆ 28 ⁺ ₁₀₀	5.5k	⁴ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
90 ⁺ ₁ 2 ⁺ ₁ 50 ⁺ ₂₂		⁵ UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow \pi^0 \pi^0$
108 ⁺ ₁₁ 14 ± 25		⁶ ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
121 ± 8		AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
257 ± 33	9.9k	AUBERT	060 BABR	$B^+ \rightarrow K^+ K^+ K^-$
108 ± 9	80k	^{6,7} UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
119 ± 10		VLADIMIRSK...	06 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
90 ± 15		⁶ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$
136 ± 23	1400	⁸ GARMASH	05 BELL	$B^+ \rightarrow K^+ K^+ K^-$
140 ± 40		⁶ ABELE	01 CBAR	$0.0 \bar{p} d \rightarrow \pi^- 4\pi^0 p$
104 ± 25		⁶ BARBERIS	99 OMEG	$450 p p \rightarrow p_s p_f K^+ K^-$
131 ± 15		⁶ BARBERIS	99B OMEG	$450 p p \rightarrow p_s p_f \pi^+ \pi^-$
160 ± 50		⁶ BELLAZZINI	99 GAM4	$450 p p \rightarrow p p \pi^0 \pi^0$
100 ± 33		⁶ FRENCH	99	$300 p p \rightarrow p_f (K^+ K^-) p_s$
280 ± 100		⁶ ALDE	98 GAM4	$100 \pi^- p \rightarrow \pi^0 \pi^0 n$
~ 100		FRABETTI	97D E687	$D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$
~ 169		ABELE	96 CBAR	$0.0 \bar{p} p \rightarrow 5\pi^0$
100 ± 30	120	⁶ AMELIN	96B VES	$37 \pi^- A \rightarrow \eta \eta \pi^- A$
132 ± 15		BUGG	96 RVUE	
120 ± 25		⁹ AMSLER	95B CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
120 ± 30		¹⁰ AMSLER	95C CBAR	$0.0 \bar{p} p \rightarrow \eta \eta \pi^0$
65 ± 10		¹¹ ANTINORI	95 OMEG	$300,450 p p \rightarrow p p 2(\pi^+ \pi^-)$

NODE=M152W

NODE=M152W

OCCUR=2

199 ± 30		⁶ ANTINORI	95	OMEG	300,450 $p p \rightarrow p p \pi^+ \pi^-$
56 ± 12		⁶ ABATZIS	94	OMEG	450 $p p \rightarrow p p 2(\pi^+ \pi^-)$
100 ± 40		⁶ AMSLER	94E	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \eta \eta'$
245 ± 50		⁶ AMSLER	92	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \eta \eta$
153 ± 67 ± 50		⁶ BELADIDZE	92C	VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
78 ± 18		⁶ ARMSTRONG	89E	OMEG	300 $p p \rightarrow p p 2(\pi^+ \pi^-)$
170 ± 40		⁶ ALDE	88	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$
150 ± 20	600	⁶ ALDE	87	GAM4	100 $\pi^- p \rightarrow 4\pi^0 n$
265 ± 65		¹² ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta n$
260 ± 60		⁶ BINON	84C	GAM2	38 $\pi^- p \rightarrow \eta \eta' n$
210 ± 40		⁶ BINON	83	GAM2	38 $\pi^- p \rightarrow 2\eta n$
101 ± 13		⁶ GRAY	83	DBC	0.0 $\bar{p} N \rightarrow 3\pi$

¹ Breit-Wigner width.

² The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.

³ Solution I, statistical error only.

⁴ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁵ Breit-Wigner width. May also be the $f_0(1370)$.

⁶ Breit-Wigner width.

⁷ Statistical error only.

⁸ Breit-Wigner, solution 1, PWA ambiguous.

⁹ T-matrix pole, supersedes ANISOVICH 94.

¹⁰ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.

¹¹ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.

¹² From central value and spread of two solutions. Breit-Wigner mass.

OCCUR=2

NODE=M152W;LINKAGE=PP
NODE=M152W;LINKAGE=J

NODE=M152W;LINKAGE=G
NODE=M152W;LINKAGE=C

NODE=M152W;LINKAGE=UE
NODE=M152W;LINKAGE=E
NODE=M152W;LINKAGE=ST
NODE=M152W;LINKAGE=GA
NODE=M152W;LINKAGE=D
NODE=M152W;LINKAGE=D1
NODE=M152W;LINKAGE=B
NODE=M152W;LINKAGE=AZ

$f_0(1500)$ DECAY MODES

NODE=M152215;NODE=M152

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 $\pi\pi$	$(34.5 \pm 2.2) \%$	1.2
Γ_2 $\pi^+ \pi^-$	seen	
Γ_3 $2\pi^0$	seen	
Γ_4 4π	$(48.9 \pm 3.3) \%$	1.2
Γ_5 $4\pi^0$	seen	
Γ_6 $2\pi^+ 2\pi^-$	seen	
Γ_7 $2(\pi\pi)S\text{-wave}$	seen	
Γ_8 $\rho\rho$	seen	
Γ_9 $\pi(1300)\pi$	seen	
Γ_{10} $a_1(1260)\pi$	seen	
Γ_{11} $\eta\eta$	$(6.0 \pm 0.9) \%$	1.1
Γ_{12} $\eta\eta'(958)$	$(2.2 \pm 0.8) \%$	1.4
Γ_{13} $K\bar{K}$	$(8.5 \pm 1.0) \%$	1.1
Γ_{14} $\gamma\gamma$	not seen	

DESIG=8
DESIG=9
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=7
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=12;OUR EST;→ UNCHECKED ←
DESIG=13;OUR EST;→ UNCHECKED ←
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=2
DESIG=4
DESIG=10;OUR EST;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to 6 branching ratios uses 10 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 5.6$ for 6 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_4	−88			
x_{11}	27	−56		
x_{12}	3	−32	26	
x_{13}	43	−64	20	2
	x_1	x_4	x_{11}	x_{12}

$f_0(1500) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M152217

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{14} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M152G1
NODE=M152G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$33^{+12}_{-6} + 1809_{21}$	¹ UEHARA	08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
not seen	ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$
<460	95 BARATE	00E	ALEP	$\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ May also be the $f_0(1370)$. Multiplied by us by 3 to obtain the $\pi\pi$ value.

NODE=M152G1;LINKAGE=UE

 $f_0(1500) \text{ BRANCHING RATIOS}$

NODE=M152220

 $\Gamma(\pi\pi) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	DOCUMENT ID	TECN

NODE=M152R8
NODE=M152R8

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.454 ± 0.104	BUGG	96	RVUE

 $\Gamma(\pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R10
NODE=M152R10

seen BERTIN 98 OBLX $0.05\text{--}0.405 \bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen FRABETTI 97D E687 $D_s^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$

 $\Gamma(4\pi) / \Gamma(\pi\pi)$ Γ_4 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R6
NODE=M152R6

1.42 ± 0.18 OUR FIT Error includes scale factor of 1.2.

1.42 ± 0.18 OUR AVERAGE Error includes scale factor of 1.2.

1.37 ± 0.16 BARBERIS 00D $450 p p \rightarrow p_f 4\pi p_s$

2.1 ± 0.6 ¹ AMSLER 98 RVUE

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.1 ± 0.2 ² ANISOVICH 02D SPEC Combined fit

3.4 ± 0.8 ¹ ABELE 96 CBAR $0.0 \bar{p} p \rightarrow 5\pi^0$

¹ Excluding $\rho\rho$ contribution to 4π .

² From a combined K-matrix analysis of Crystal Barrel ($0. p \bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta \eta n, \eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.

NODE=M152R6;LINKAGE=C
NODE=M152R6;LINKAGE=CH

 $\Gamma(2(\pi\pi) \text{ s-wave}) / \Gamma(\pi\pi)$ Γ_7 / Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R14
NODE=M152R14

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.42 ± 0.26 ¹ ABELE 01 CBAR $0.0 \bar{p} d \rightarrow \pi^- 4\pi^0 p$

¹ From the combined data of ABELE 96 and ABELE 96C.

NODE=M152R;LINKAGE=KZ

 $\Gamma(2(\pi\pi) \text{ s-wave}) / \Gamma(4\pi)$ Γ_7 / Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R15
NODE=M152R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.26 ± 0.07 ABELE 01B CBAR $0.0 \bar{p} d \rightarrow 5\pi p$

 $\Gamma(\rho\rho) / \Gamma(4\pi)$ Γ_8 / Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R16
NODE=M152R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13 ± 0.08 ABELE 01B CBAR $0.0 \bar{p} d \rightarrow 5\pi p$

 $\Gamma(\rho\rho) / \Gamma(2(\pi\pi) \text{ s-wave})$ Γ_8 / Γ_7

VALUE	DOCUMENT ID	COMMENT

NODE=M152R11
NODE=M152R11

2.87 ± 0.34 OUR AVERAGE Error includes scale factor of 1.1.

3.3 ± 0.5 BARBERIS 00C $450 p p \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$

2.6 ± 0.4 BARBERIS 00C $450 p p \rightarrow p_f 2(\pi^+ \pi^-) p_s$

OCCUR=2

 $\Gamma(\pi(1300)\pi) / \Gamma(4\pi)$ Γ_9 / Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M152R17
NODE=M152R17

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.50 ± 0.25 ABELE 01B CBAR $0.0 \bar{p} d \rightarrow 5\pi p$

$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_{10}/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.12 ± 0.05	ABELE	01B	CBAR $0.0 \bar{p}d \rightarrow 5\pi p$

NODE=M152R18
 NODE=M152R18

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
large	ALDE	88	GAM4 $300 \pi^- N \rightarrow \eta\eta\pi^- N$
large	BINON	83	GAM2 $38 \pi^- p \rightarrow 2\eta n$

NODE=M152R1
 NODE=M152R1

 $\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.173 ± 0.024 OUR FIT Error includes scale factor of 1.1.			
0.175 ± 0.027 OUR AVERAGE			
0.18 ± 0.03	BARBERIS	00E	$450 p\bar{p} \rightarrow p_f \eta\eta p_s$
0.157 ± 0.060	¹ AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.080 ± 0.033	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \eta\eta, \pi^0 \pi^0 \pi^0$
0.11 ± 0.03	² ANISOVICH	02D	SPEC Combined fit
0.078 ± 0.013	³ ABELE	96C	RVUE Compilation
0.230 ± 0.097	⁴ AMSLER	95C	CBAR $0.0 \bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M152R13
 NODE=M152R13

¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

² From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

³ 2π width determined to be 60 ± 12 MeV.

⁴ Using AMSLER 95B ($3\pi^0$).

NODE=M152R3;LINKAGE=AB
 NODE=M152R;LINKAGE=CH

NODE=M152R3;LINKAGE=CM
 NODE=M152R3;LINKAGE=A

 $\Gamma(4\pi^0)/\Gamma(\eta\eta)$ Γ_5/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.8 ± 0.3	ALDE	87	GAM4 $100 \pi^- p \rightarrow 4\pi^0 n$

NODE=M152R5
 NODE=M152R5

 $\Gamma(\eta\eta'(958))/\Gamma(\pi\pi)$ Γ_{12}/Γ_1

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
6.4 ± 2.2 OUR FIT Error includes scale factor of 1.4.			
9.5 ± 2.6	BARBERIS	00A	$450 p\bar{p} \rightarrow p_f \eta\eta p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$16.6^{+4.2}_{-4.0}$	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
0.5 ± 0.3	² ANISOVICH	02D	SPEC Combined fit

NODE=M152R12
 NODE=M152R12

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P-wave.

² From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M152R12;LINKAGE=A

NODE=M152R12;LINKAGE=CH

 $\Gamma(\eta\eta'(958))/\Gamma(\eta\eta)$ Γ_{12}/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.37 ± 0.13 OUR FIT Error includes scale factor of 1.5.			
0.29 ± 0.10	¹ AMSLER	95C	CBAR $0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.05 ± 0.03	² ANISOVICH	02D	SPEC Combined fit
0.84 ± 0.23	ABELE	96C	RVUE Compilation
2.7 ± 0.8	BINON	84C	GAM2 $38 \pi^- p \rightarrow \eta\eta' n$

NODE=M152R2
 NODE=M152R2

¹ Using AMSLER 94E ($\eta\eta'\pi^0$).

² From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta\eta, \pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n, \eta\eta n, \eta\eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

NODE=M152R2;LINKAGE=A
 NODE=M152R2;LINKAGE=CH

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.044 ± 0.021	BUGG	96	RVUE

NODE=M152R9
 NODE=M152R9

$\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_{13}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.246±0.025 OUR FIT**0.236±0.026 OUR AVERAGE**

0.25 ±0.03	¹ BARGIOTTI	03	OBLX $\bar{p}p$
0.19 ±0.07	² ABELE	98	CBAR $0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
0.20 ±0.08	³ ABELE	96B	CBAR $0.0 \bar{p}p \rightarrow \pi_L^0 K_L^0 K_L^0$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

0.16 ±0.05	⁴ ANISOVICH	02D	SPEC Combined fit
0.33 ±0.03 ±0.07	BARBERIS	99D	OMEG $450 pp \rightarrow K^+ K^-, \pi^+ \pi^-$

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.² Using $\pi^0 \pi^0$ from AMSLER 95B.³ Using AMSLER 95B ($3\pi^0$), AMSLER 94C ($2\pi^0 \eta$) and SU(3).⁴ From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.NODE=M152R7
NODE=M152R7NODE=M152R;LINKAGE=BG
NODE=M152R7;LINKAGE=A
NODE=M152R7;LINKAGE=D
NODE=M152R7;LINKAGE=CH $\Gamma(K\bar{K})/\Gamma(\eta\eta)$ Γ_{13}/Γ_{11}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

1.43±0.24 OUR FIT Error includes scale factor of 1.1.**1.85±0.41** BARBERIS 00E 450 $pp \rightarrow p_f \eta \eta p_S$

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

1.5 ±0.6	¹ ANISOVICH	02D	SPEC Combined fit
<0.4	90	² PROKOSHKIN	91 GAM4 $300 \pi^- p \rightarrow \pi^- p \eta \eta$
<0.6		³ BINON	83 GAM2 $38 \pi^- p \rightarrow 2 \eta n$

¹ From a combined K-matrix analysis of Crystal Barrel ($0. p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K \bar{K} n$) data.² Combining results of GAM4 with those of WA76 on $K \bar{K}$ central production.³ Using ETKIN 82B and COHEN 80.NODE=M152R4
NODE=M152R4

NODE=M152R4;LINKAGE=CH

NODE=M152R4;LINKAGE=BZ
NODE=M152R4;LINKAGE=A

$\phi_0(1500)$ REFERENCES

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22G	PRL 129 042001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ROPERTZ	18	EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)
AAIJ	17V	JHEP 1708 037	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
AAIJ	14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
KLEMP	08	EPJ C55 39	E. Klemp, M. Matveev, A.V. Sarantsev	(BONN+)
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>	
		Translated from YAF 65 1583.		
ABELE	01	EPJ C19 667	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00D	PL B474 423	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)
BELLAZZINI	99	PL B467 296	R. Bellazzini <i>et al.</i>	
FRENCH	99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
AMSLER	98	RMP 70 1293	C. Amsler	
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>	
		Translated from UFN 168 481.		

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REFID=47400
REFID=47491
REFID=46927
REFID=45863
REFID=46605
REFID=46914REFID=46601
REFID=46331

BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
REYES	98	PRL 81 4079	M.A. Reyes <i>et al.</i>	
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
FRABETTI	97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ABELE	96	PL B380 453	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	96B	PL B385 425	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
Translated from YAF 59 1021.				
BUGG	96	NP B471 59	D.V. Bugg, A.V. Sarantsev, B.S. Zou	(LOQM, PNPI)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	94E	PL B340 259	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bitjukov, G.V. Borisov	(SERP+)
Translated from YAF 55 2748.				
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)
Translated from DANS 316 900.				
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE	88	PL B201 160	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Also				
Translated from YAF 38 934.				
GRAY	83	PR D27 307	L. Gray <i>et al.</i>	(SYRA)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)

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NODE=M084

$f_1(1510)$

$I^G(J^{PC}) = 0^+(1^{++})$

OMITTED FROM SUMMARY TABLE
See the review on "Spectroscopy of Light Meson Resonances."

NODE=M084

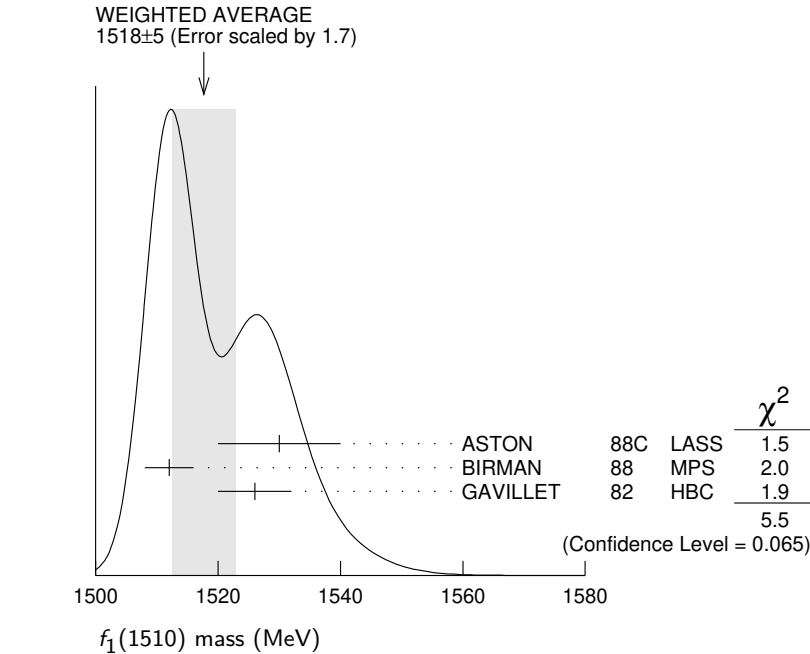
NODE=M084M

NODE=M084M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1518± 5 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
1530±10		ASTON	88C LASS	11 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$
1512± 4	600	¹ BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1526± 6	271	GAVILLET	82 HBC	4.2 $K^- p \rightarrow \Lambda K K \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1525		² BAUER	93B	$\gamma \gamma^* \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
¹ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ state.				
² Not seen by AIHARA 88C in the $K_S^0 K^\pm \pi^\mp$ final state.				

NODE=M084M;LINKAGE=A

NODE=M084M;LINKAGE=C



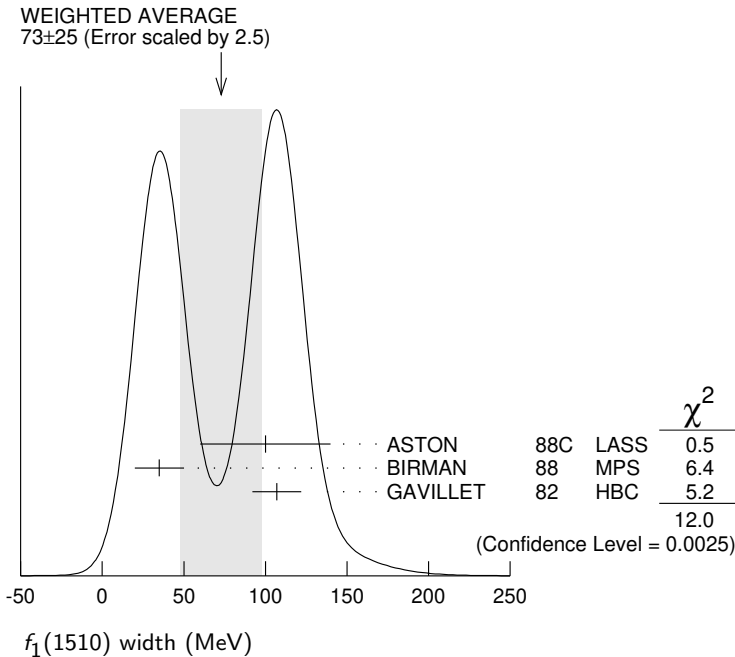
f₁(1510) WIDTH

NODE=M084W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
73±25 OUR AVERAGE Error includes scale factor of 2.5. See the ideogram below.				
100±40		ASTON	88C LASS	11 $K^- p \rightarrow K_S^0 K^\pm \pi^\mp \Lambda$
35±15	600	³ BIRMAN	88 MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
107±15	271	GAVILLET	82 HBC	4.2 $K^- p \rightarrow \Lambda K K \pi$
³ From partial wave analysis of $K^+ \bar{K}^0 \pi^-$ state.				

NODE=M084W

NODE=M084W;LINKAGE=A



f₁(1510) DECAY MODES

NODE=M084215;NODE=M084

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}^*(892) + \text{c.c.}$	seen
Γ_2 $\pi^+ \pi^- \eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

f₁(1510) BRANCHING RATIOS

NODE=M084225

$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$			Γ_2/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	230	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M084R01
NODE=M084R01

f₁(1510) REFERENCES

NODE=M084

ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BAUER	93B	PR D48 3976	D.A. Bauer <i>et al.</i>	(SLAC)
AIHARA	88C	PR D38 1	H. Aihara <i>et al.</i>	(TPC-2γ Collab.)
ASTON	88C	PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP
GAVILLET	82	ZPHY C16 119	P. Gavillet <i>et al.</i>	(CERN, CDEF, PADO+)

REFID=53684
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REFID=20877

NODE=M013

 $f'_2(1525)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f'_2(1525)$ MASS

NODE=M013MX

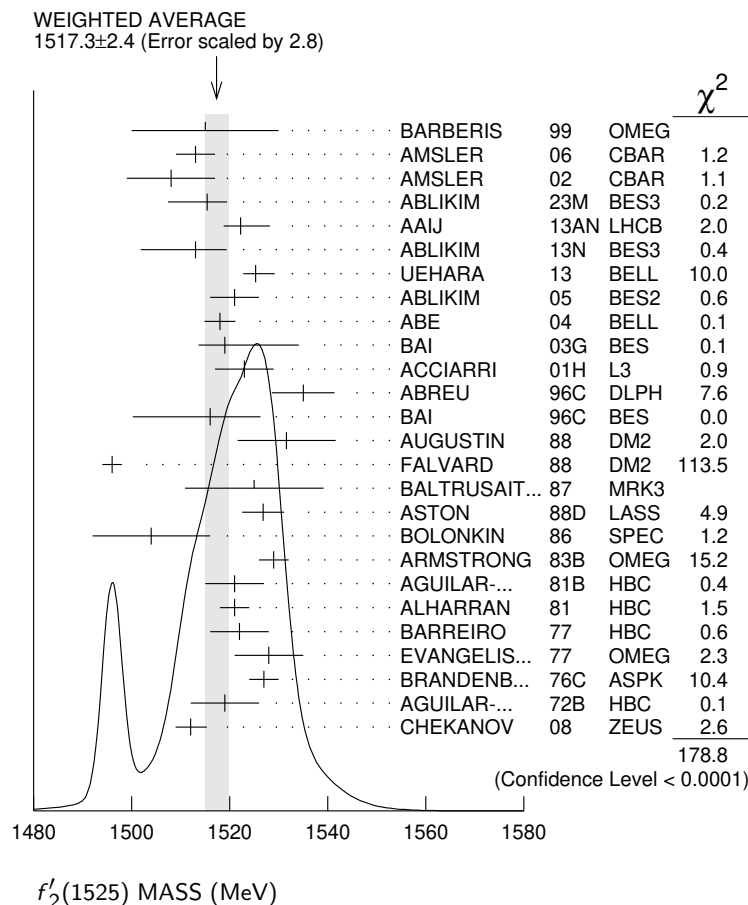
VALUE (MeV)

DOCUMENT ID

1517.3±2.4 OUR AVERAGE Includes data from the 6 datablocks that follow this one.
Error includes scale factor of 2.8. See the ideogram below. [1517.4 ± 2.5 MeV OUR 2023
AVERAGE Scale factor = 2.8]

NODE=M013MX

NEW



PRODUCED BY PION BEAM

NODE=M013M1
NODE=M013M1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

1521±13	TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1547 $^{+10}_{-2}$	¹ LONGACRE	86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1496 $^{+9}_{-8}$	² CHABAUD	81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
1497 $^{+8}_{-9}$	CHABAUD	81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
1492±29	GORLICH	80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
1502±25	³ CORDEN	79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
1480	14 CRENNELL	66	HBC	6.0 $\pi^- p \rightarrow K_S^0 K_S^0 n$

OCCUR=2

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.² CHABAUD 81 is a reanalysis of PAWLICKI 77 data.³ From an amplitude analysis where the $f'_2(1525)$ width and elasticity are in complete disagreement with the values obtained from $K\bar{K}$ channel, making the solution dubious.NODE=M013M;LINKAGE=L
NODE=M013M;LINKAGE=D
NODE=M013M;LINKAGE=N

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013M2
NODE=M013M2

1518.0 ± 2.7 OUR AVERAGE Includes data from the datablock that follows this one.
Error includes scale factor of 2.9. See the ideogram below. [1518.1 ± 2.8 MeV OUR 2023
AVERAGE Scale factor = 3.0]

NEW

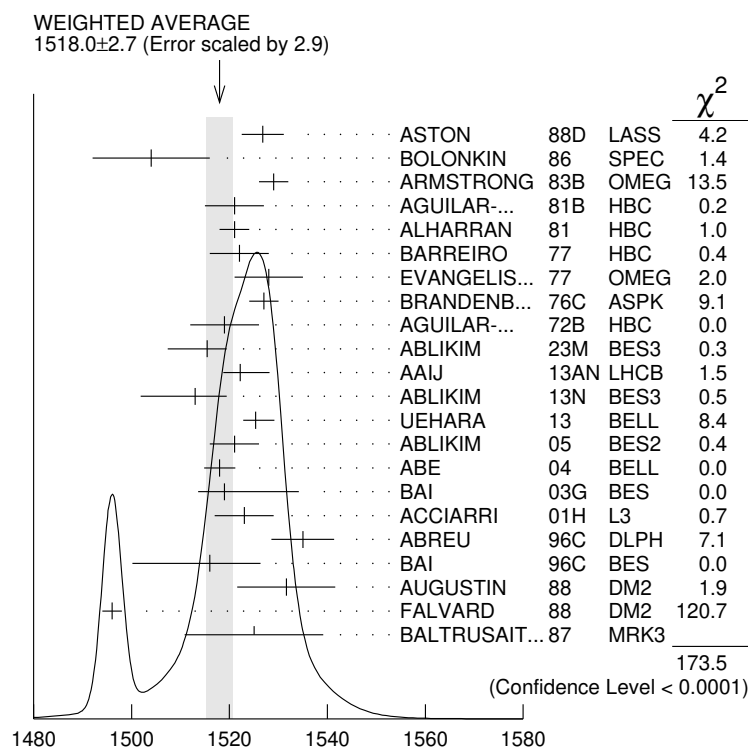
1526.8 ± 4.3		ASTON	88D	LASS	11	$K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1504 ± 12		BOLONKIN	86	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 \Upsilon$
1529 ± 3		ARMSTRONG	83B	OMEG	18.5	$K^- p \rightarrow K^- K^+ \Lambda$
1521 ± 6	650	AGUILAR-...	81B	HBC	4.2	$K^- p \rightarrow \Lambda K^+ K^-$
1521 ± 3	572	ALHARRAN	81	HBC	8.25	$K^- p \rightarrow \Lambda K \bar{K}$
1522 ± 6	123	BARREIRO	77	HBC	4.15	$K^- p \rightarrow \Lambda K_S^0 K_S^0$
1528 ± 7	166	EVANGELIS...	77	OMEG	10	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1527 ± 3	120	BRANDENB...	76C	ASPK	13	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
1519 ± 7	100	AGUILAR-...	72B	HBC	3.9,4.6	$K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1514 ± 8	61	BINON	07	GAMS	32.5	$K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
1513 ± 10		¹ BARKOV	99	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 \Upsilon$

¹ Systematic errors not estimated.

NODE=M013M2;LINKAGE=SK

PRODUCED BY $K^\pm$ BEAM (MeV)**PRODUCED IN e^+e^- ANNIHILATION AND PARTICLE DECAYS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013M3
NODE=M013M3

1514 ± 4 OUR AVERAGE Error includes scale factor of 3.6. See the ideogram below.
[1514⁺⁵₋₄ MeV OUR 2023 AVERAGE Scale factor = 3.8]

NEW

1515.4 ± 2.5 ^{+3.2} _{-7.6}	126K	ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
1522.2 ± 2.8 ^{+5.3} _{-2.0}		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
1513 ± 5 ⁺⁴ ₋₁₀	5.5k	¹ ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1525.3 ^{+1.2} _{-1.4} ± 3.7 _{-2.1}		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
1521 ± 5		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
1518 ± 1 ± 3		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1519 ± 2 ⁺¹⁵ ₋₅		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$

1523 ± 6	331	² ACCIARRI	01H L3	91, 183–209 $e^+e^- \rightarrow e^+e^-K_S^0K_S^0$
1535 ± 5 ± 4		ABREU	96C DLPH	$Z^0 \rightarrow K^+K^- + X$
1516 ± 5 $^{+9}_{-15}$		BAI	96C BES	$J/\psi \rightarrow \gamma K^+K^-$
1531.6 ± 10.0		AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+K^-$
1496 ± 2		³ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+K^-$
1525 ± 10 ± 10		BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1518 ± 3		⁴ KLEMP	22 RVUE	$J/\psi(1S) \rightarrow \gamma \pi^0 \pi^0, \gamma K_S^0 K_S^0$
1503 ± 11		⁵ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
1532 ± 3 ± 6	644	^{6,7} DOBBS	15	$J/\psi \rightarrow \gamma K^+K^-$
1557 ± 9 ± 3	113	^{6,7} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+K^-$
1526 ± 7	29	⁸ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+K^- \gamma$
1523 ± 5	870	⁹ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1515 ± 5		¹⁰ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+K^-$

OCCUR=2

OCCUR=2

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Supersedes ACCIARRI 95J.

³ From an analysis including interference with $f_0(1710)$.

⁴ Fit of the tensor partial waves from BES3 in the multipole basis.

⁵ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).

⁶ Using CLEO-c data but not authored by the CLEO Collaboration.

⁷ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 73$ MeV.

⁸ From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.

⁹ From analysis of L3 data at 91 and 183–209 GeV.

¹⁰ From an analysis ignoring interference with $f_0(1710)$.

NODE=M013M3;LINKAGE=A

NODE=M013M;LINKAGE=HA

NODE=M013M;LINKAGE=F2

NODE=M013M3;LINKAGE=F

NODE=M013M3;LINKAGE=E

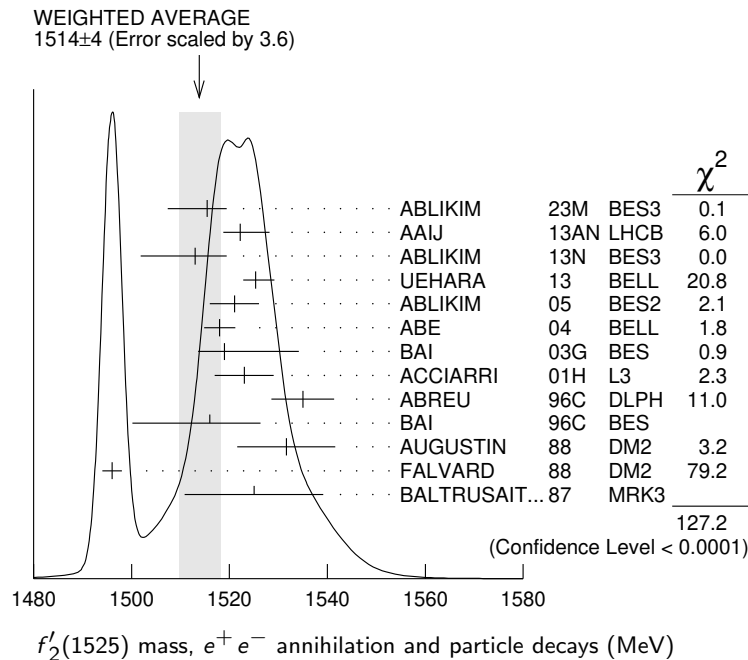
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NODE=M013M3;LINKAGE=C

NODE=M013M3;LINKAGE=D

NODE=M013M3;LINKAGE=SC

NODE=M013M;LINKAGE=F1



PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV) DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

1512 ± 4 OUR AVERAGE

1513 ± 4	AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1508 ± 9	¹ AMSLER	02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1495.0 ± 1.1 ± 8.1	² ALBRECHT	20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+K^-$
1530 ± 12	³ ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$

NODE=M013M9

NODE=M013M9

- ¹ T-matrix pole.
- ² T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 (KK), BINON 83 ($\eta\eta$).
- ³ 4-poles, 5-channel K matrix fit.

NODE=M013M;LINKAGE=TT
NODE=M013M9;LINKAGE=A
NODE=M013M9;LINKAGE=AN

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013M4
NODE=M013M4

1515±15 BARBERIS 99 OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$

PRODUCED IN ep COLLISIONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013M10
NODE=M013M10

1512±3^{+1.4}_{-0.5} ¹ CHEKANOV 08 ZEUS $ep \rightarrow K_S^0 K_S^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1537⁺⁹₋₈ 84 ² CHEKANOV 04 ZEUS $ep \rightarrow K_S^0 K_S^0 X$

¹ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

² Systematic errors not estimated.

NODE=M013M10;LINKAGE=HE
NODE=M013M10;LINKAGE=CH

$f_2'(1525)$ WIDTH

VALUE (MeV)	DOCUMENT ID

NODE=M013WX
NODE=M013WX

72 ⁺⁷₋₆ OUR FIT

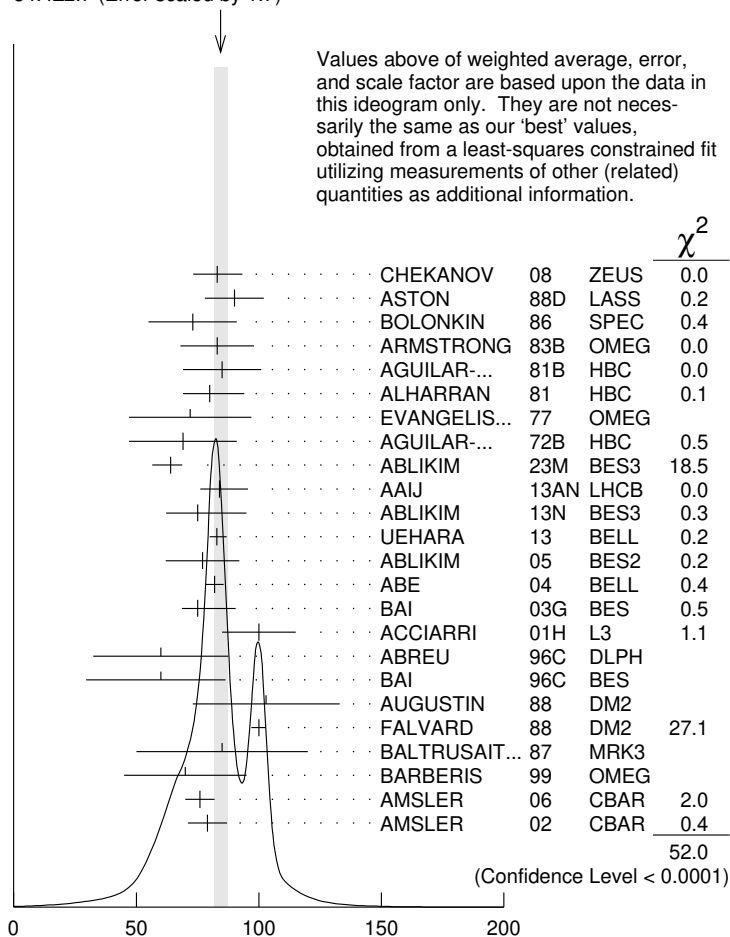
[86 ± 5 MeV OUR 2023 FIT Scale factor = 2.2]

NEW

84.4±2.7 OUR AVERAGE Includes data from the 6 datablocks that follow this one. Error includes scale factor of 1.7. See the ideogram below. [86.9 ± 2.2 MeV OUR 2023 AVERAGE]

NEW

WEIGHTED AVERAGE
84.4±2.7 (Error scaled by 1.7)



$f'_2(1525)$ WIDTH (MeV)

PRODUCED BY PION BEAM

VALUE (MeV) DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013W1
NODE=M013W1

• • • We do not use the following data for averages, fits, limits, etc. • • •

102±42	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
108 $^{+5}_{-2}$	¹ LONGACRE 86	MPS	22 $\pi^- p \rightarrow K_S^0 K_S^0 n$
69 $^{+22}_{-16}$	² CHABAUD 81	ASPK	6 $\pi^- p \rightarrow K^+ K^- n$
137 $^{+23}_{-21}$	CHABAUD 81	ASPK	18.4 $\pi^- p \rightarrow K^+ K^- n$
150 $^{+83}_{-50}$	GORLICH 80	ASPK	17 $\pi^- p$ polarized $\rightarrow K^+ K^- n$
165±42	³ CORDEN 79	OMEG	12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$
92 $^{+39}_{-22}$	⁴ POLYCHRO... 79	STRC	7 $\pi^- p \rightarrow n K_S^0 K_S^0$

OCCUR=2

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² CHABAUD 81 is a reanalysis of PAWLICKI 77 data.

³ From an amplitude analysis where the $f'_2(1525)$ width and elasticity are in complete disagreement with the values obtained from $K\bar{K}$ channel, making the solution dubious.

⁴ From a fit to the D with $f_2(1270)$ - $f'_2(1525)$ interference. Mass fixed at 1516 MeV.

NODE=M013W;LINKAGE=L
NODE=M013W;LINKAGE=D
NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M

PRODUCED BY $K^\pm$ BEAM

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013W2
NODE=M013W2

82± 6 OUR AVERAGE

90±12	ASTON 88D	LASS	11 $K^- p \rightarrow K_S^0 K_S^0 \Lambda$
73±18	BOLONKIN 86	SPEC	40 $K^- p \rightarrow K_S^0 K_S^0 Y$
83±15	ARMSTRONG 83B	OMEG	18.5 $K^- p \rightarrow K^- K^+ \Lambda$

85 ± 16	650	AGUILAR-...	81B	HBC	$4.2 K^- p \rightarrow \Lambda K^+ K^-$
80^{+14}_{-11}	572	ALHARRAN	81	HBC	$8.25 K^- p \rightarrow \Lambda K \bar{K}$
72 ± 25	166	EVANGELIS...	77	OMEG	$10 K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
69 ± 22	100	AGUILAR-...	72B	HBC	$3.9, 4.6 K^- p \rightarrow K \bar{K} (\Lambda, \Sigma)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

92^{+25}_{-16}	61	BINON	07	GAMS	$32.5 K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
75 ± 20		¹ BARKOV	99	SPEC	$40 K^- p \rightarrow K_S^0 K_S^0 \gamma$
62^{+19}_{-14}	123	BARREIRO	77	HBC	$4.15 K^- p \rightarrow \Lambda K_S^0 K_S^0$
61 ± 8	120	BRANDENB...	76C	ASPK	$13 K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

¹ Systematic errors not estimated.

NODE=M013W2;LINKAGE=SK

PRODUCED IN e^+e^- ANNIHILATION AND PARTICLE DECAYS

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M013W3
NODE=M013W3

86 ± 4 OUR AVERAGE Error includes scale factor of 2.4. See the ideogram below.
[$89.2^{+3.4}_{-3.0}$ MeV OUR 2023 AVERAGE Scale factor = 1.8]

NEW

$64.0 \pm 4.3^{+2.0}_{-6.1}$	126K	ABLIKIM	23M	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \pi^0$
$84 \pm 6^{+10}_{-5}$		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
$75^{+12}_{-10}^{+16}_{-8}$	5.5k	¹ ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
$82.9^{+2.1+3.3}_{-2.2-2.0}$		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
77 ± 15		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi K^+ K^-$
$82 \pm 2 \pm 3$		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
$75 \pm 4^{+15}_{-5}$		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
100 ± 15	331	² ACCIARRI	01H	L3	$91, 183-209 e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$
$60 \pm 20 \pm 19$		ABREU	96C	DLPH	$Z^0 \rightarrow K^+ K^- + X$
$60 \pm 23^{+13}_{-20}$		BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$
103 ± 30		AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K^+ K^-$
100 ± 3		³ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$
85 ± 35		BALTRUSAIT..87	MRK3		$J/\psi \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

78 ± 6		⁴ KLEMP	22	RVUE	$J/\psi(1S) \rightarrow \gamma \pi^0 \pi^0, \gamma K_S^0 K_S^0$
84 ± 15		⁵ RODAS	22	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K})$
37 ± 12	29	⁶ LEES	14H	BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
104 ± 10	870	⁷ SCHEGELSKY	06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$
62 ± 10		⁸ FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Supersedes ACCIARRI 95J.

³ From an analysis including interference with $f_0(1710)$.

⁴ Fit of the tensor partial waves from BES3 in the multipole basis.

⁵ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).

⁶ From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.

⁷ From analysis of L3 data at 91 and 183–209 GeV.

⁸ From an analysis ignoring interference with $f_0(1710)$.

NODE=M013W3;LINKAGE=A

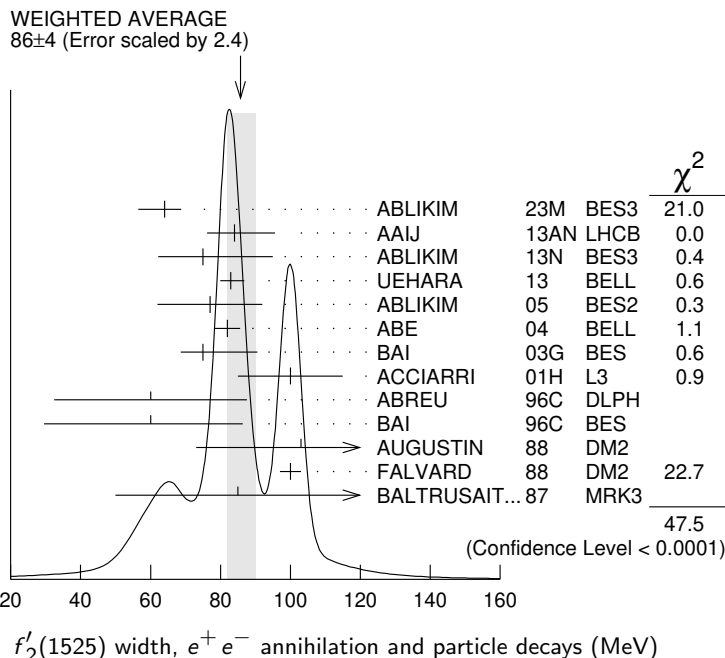
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NODE=M013W;LINKAGE=F2
NODE=M013W3;LINKAGE=D
NODE=M013W3;LINKAGE=C

NODE=M013W3;LINKAGE=B

NODE=M013W3;LINKAGE=SC
NODE=M013W;LINKAGE=F1

I

OCCUR=2



PRODUCED IN $\bar{p}p$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

77 ± 5 OUR AVERAGE

76 ± 6	AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
79 ± 8	¹ AMSLER	02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
104.8 ± 0.9 ± 9.8	² ALBRECHT	20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
128 ± 20	³ ANISOVICH	09	RVUE	0.0 $\bar{p}p, \pi N$
¹ T-matrix pole.				
² T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).				
³ K-matrix, 4-poles, 5-channel fit.				

NODE=M013W9
NODE=M013W9

NODE=M013W9;LINKAGE=TT
NODE=M013W9;LINKAGE=A

NODE=M013W9;LINKAGE=AN

CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

70±25 BARBERIS 99 OMEG 450 $pp \rightarrow p_s p_f K^+ K^-$

PRODUCED IN $e p$ COLLISIONS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

83± 9⁺⁵₋₄ ¹ CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

50⁺³⁴₋₂₂ 84 ² CHEKANOV 04 ZEUS $e p \rightarrow K_S^0 K_S^0 X$

¹ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f'_2(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

² Systematic errors not estimated.

NODE=M013W10
NODE=M013W10

NODE=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

$f'_2(1525)$ DECAY MODES

NODE=M013215;NODE=M013

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	(88.8 ± 2.2) %
Γ_2 $\eta\eta$	(10.3 ± 2.2) %
Γ_3 $\pi\pi$	(8.2 ± 1.5) × 10 ⁻³
Γ_4 $K\bar{K}^*(892) + \text{c.c.}$	

DESIG=2

DESIG=4

DESIG=1

DESIG=3

Γ_5	$\pi K \bar{K}$	
Γ_6	$\pi \pi \eta$	
Γ_7	$\pi^+ \pi^+ \pi^- \pi^-$	
Γ_8	$\gamma \gamma$	$(1.12 \pm 0.15) \times 10^{-6}$

DESIG=6
DESIG=5
DESIG=7
DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to 2 partial widths, a combination of partial widths obtained from integrated cross sections, and 3 branching ratios uses 16 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 14.2$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-100			
x_3	-5	-1		
x_8	0	0	1	
Γ	-28	28	-1	-62
	x_1	x_2	x_3	x_8

Mode	Rate (MeV)
Γ_1 $K \bar{K}$	64 $\begin{smallmatrix} +6 \\ -5 \end{smallmatrix}$
Γ_2 $\eta \eta$	7.4 ± 1.9
Γ_3 $\pi \pi$	0.59 ± 0.12
Γ_8 $\gamma \gamma$	$(8.1 \pm 0.9) \times 10^{-5}$

DESIG=2
DESIG=4
DESIG=1
DESIG=8

$f'_2(1525)$ PARTIAL WIDTHS

$\Gamma(K \bar{K})$

Γ_1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

64^{+6}_{-5} OUR FIT

[75 $\pm$ 4 MeV OUR 2023 FIT Scale factor = 1.8]

63^{+6}_{-5} ¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

NODE=M013220
NODE=M013W6
NODE=M013W6

NEW

NODE=M013PW;LINKAGE=L

$\Gamma(\eta \eta)$

Γ_2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

7.4 ± 1.9 OUR FIT

[9.9 $\pm$ 1.9 MeV OUR 2023 FIT Scale factor = 1.1]

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.0 $\pm$ 0.8 870 ¹ SCHEGELSKY 06A RVUE $\gamma \gamma \rightarrow K_S^0 K_S^0$

24 $\begin{smallmatrix} +3 \\ -1 \end{smallmatrix}$ ² LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f'_2(1525) \rightarrow K \bar{K}) = 68$ MeV and SU(3) relations.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

NODE=M013W7
NODE=M013W7
NEW

NODE=M013W7;LINKAGE=SC

NODE=M013PW7;LINKAGE=L

$\Gamma(\pi \pi)$

Γ_3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.59 ± 0.12 OUR FIT

[0.71 $\pm$ 0.14 MeV OUR 2023 FIT Scale factor = 1.1]

$1.4^{+1.0}_{-0.5}$ ¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow K_S^0 K_S^0 n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.2 $\begin{smallmatrix} +1.0 \\ -0.2 \end{smallmatrix}$ 870 ² SCHEGELSKY 06A RVUE $\gamma \gamma \rightarrow K_S^0 K_S^0$

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.

² From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f'_2(1525) \rightarrow K \bar{K}) = 68$ MeV and SU(3) relations.

NODE=M013W5
NODE=M013W5
NEW

NODE=M013PW5;LINKAGE=L

NODE=M013W5;LINKAGE=SC

$\Gamma(\gamma\gamma)$ Γ_8

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.081 ± 0.009 OUR FIT

[0.082 ± 0.009 keV OUR 2023 FIT]

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13 ± 0.03 870 ¹ SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$ ¹ From analysis of L3 data at 91 and 183–209 GeV, using $\Gamma(f_2'(1525) \rightarrow K\bar{K}) = 68$ MeV and SU(3) relations.

NODE=M013W8

NODE=M013W8

NEW

NODE=M013W8;LINKAGE=SC

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.746 ± 0.002 ^{+0.166}_{-0.162} ¹ ALBRECHT 20 RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$,
 $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$ ¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M013R00

NODE=M013R00

NODE=M013R00;LINKAGE=A

 $f_2'(1525) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M013223

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1 \Gamma_8/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.072 ± 0.007 OUR FIT**0.072 ± 0.007 OUR AVERAGE**0.048 ^{+0.067}_{-0.008} ^{+0.108}_{-0.012} UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$ 0.0564 ± 0.0048 ± 0.0116 ABE 04 BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.076 ± 0.006 ± 0.011 331 ¹ ACCIARRI 01H L3 $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.067 ± 0.008 ± 0.015 ² ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.11 ^{+0.03}_{-0.02} ± 0.02 BEHREND 89C CELL $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.10 ^{+0.04}_{-0.03} ^{+0.03}_{-0.02} BERGER 88 PLUT $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.12 ± 0.07 ± 0.04 ² AIHARA 86B TPC $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ 0.11 ± 0.02 ± 0.04 ² ALTHOFF 83 TASS $e^+ e^- \rightarrow e^+ e^- K\bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0314 ± 0.0050 ± 0.0077 ³ ALBRECHT 90G ARG $e^+ e^- \rightarrow e^+ e^- K^+ K^-$ ¹ Supersedes ACCIARRI 95J. From analysis of L3 data at 91 and 183–209 GeV,² Using an incoherent background.³ Using a coherent background.

NODE=M013G1

NODE=M013G1

OCCUR=2

NODE=M013G;LINKAGE=HA

NODE=M013G1;LINKAGE=A

NODE=M013G1;LINKAGE=B

 $f_2'(1525) \text{ BRANCHING RATIOS}$

NODE=M013225

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.059 ± 0.003 ± 0.026 ¹ ALBRECHT 20 RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$,
 $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$ seen UEHARA 10A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$ 0.10 ± 0.03 ² PROKOSHIN 91 GAM4 300 $\pi^- p \rightarrow \pi^- p \eta\eta$ ¹ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).² Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013R8

NODE=M013R8

NODE=M013R8;LINKAGE=A

NODE=M013R8;LINKAGE=B

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.116 ± 0.028 OUR FIT

[0.132 ± 0.028 OUR 2023 FIT]

0.115 ± 0.028 OUR AVERAGE0.119 ± 0.015 ± 0.036 61 ¹ BINON 07 GAMS 32.5 $K^- p \rightarrow \eta\eta(\Lambda/\Sigma^0)$ 0.11 ± 0.04 ² PROKOSHIN 91 GAM4 300 $\pi^- p \rightarrow \pi^- p \eta\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.14 90 BARBERIS 00E 450 $pp \rightarrow p_f \eta\eta p_s$ < 0.50 BARNES 67 HBC 4.6,5.0 $K^- p$

NODE=M013R3

NODE=M013R3

NEW

¹ Using the compilation of the cross sections for $f'_2(1525)$ production in $K^- p$ collisions from ASTON 88D.

² Combining results of GAM4 with those of WA76 on $K\bar{K}$ central production and results of CBAL, MRK3 and DM2 on $J/\psi \rightarrow \gamma\eta\eta$.

NODE=M013R3;LINKAGE=BI

NODE=M013R3;LINKAGE=B

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2}) CL% DOCUMENT ID TECN COMMENT

0.82±0.16 OUR FIT

[(0.83 ± 0.16) × 10⁻² OUR 2023 FIT]

0.75±0.16 OUR AVERAGE

0.7 ± 0.2 COSTA 80 OMEG 10 $\pi^- p \rightarrow K^+ K^- n$

2.7 ^{+7.1}_{-1.3} ¹GORLICH 80 ASPK 17,18 $\pi^- p$

0.75±0.25 ^{1,2}MARTIN 79 RVUE

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.4 ± 1.5 ± 1.0 ³ALBRECHT 20 RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$

< 6 95 AGUILAR-... 81B HBC 4.2 $K^- p \rightarrow \Lambda K^+ K^-$

19 ± 3 CORDEN 79 OMEG 12-15 $\pi^- p \rightarrow \pi^+ \pi^- n$

< 4.5 95 BARREIRO 77 HBC 4.15 $K^- p \rightarrow \Lambda K_S^0 K_S^0$

1.2 ± 0.4 ¹PAWLICKI 77 SPEC 6 $\pi N \rightarrow K^+ K^- N$

< 6.3 90 BRANDENB... 76C ASPK 13 $K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$

< 0.86 ¹BEUSCH 75B OSPK 8.9 $\pi^- p \rightarrow K^0 \bar{K}^0 n$

¹ Assuming that the $f'_2(1525)$ is produced by an one-pion exchange production mechanism.

² MARTIN 79 uses the PAWLICKI 77 data with different input value of the $f'_2(1525) \rightarrow K\bar{K}$ branching ratio.

³ Residue from T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

NODE=M013R1
NODE=M013R1

NEW

NODE=M013R1;LINKAGE=C

NODE=M013R1;LINKAGE=D

NODE=M013R1;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE DOCUMENT ID TECN COMMENT

0.0092±0.0018 OUR FIT

[0.0094 ± 0.0018 OUR 2023 FIT]

0.075 ± 0.035 AUGUSTIN 87 DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$

$[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ $(\Gamma_4 + \Gamma_5)/\Gamma_1$

VALUE CL% DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.35 95 AGUILAR-... 72B HBC 3.9,4.6 $K^- p$

< 0.4 67 AMMAR 67 HBC

NODE=M013R5
NODE=M013R5

$\Gamma(\pi\pi\eta)/\Gamma(K\bar{K})$ Γ_6/Γ_1

VALUE CL% DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.41 95 AGUILAR-... 72B HBC 3.9,4.6 $K^- p$

< 0.3 67 AMMAR 67 HBC

NODE=M013R4
NODE=M013R4

$\Gamma(\pi^+ \pi^+ \pi^- \pi^-)/\Gamma(K\bar{K})$ Γ_7/Γ_1

VALUE CL% DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.32 95 AGUILAR-... 72B HBC 3.9,4.6 $K^- p$

NODE=M013R6
NODE=M013R6

$f'_2(1525)$ REFERENCES

ABLIKIM	23M	JHEP 2303 121	M. Ablikim <i>et al.</i>	(BESIII Collab.)
KLEMP	22	PL B830 137171	E. Klempt <i>et al.</i>	(BONN)
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)

Translated from YAF 70 1758.

NODE=M013

REFID=62055
REFID=61646
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REFID=60439
REFID=59455
REFID=56984
REFID=56805
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REFID=55137
REFID=55387
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REFID=53641
REFID=52719
REFID=52275
REFID=52057

AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
CHEKANOV	04	PL B578 33	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=49672
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARKOV	99	JETPL 70 248	B.P. Barkov <i>et al.</i>		REFID=47379
		Translated from ZETFP 70 242.			
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
ACCIARRI	95J	PL B363 118	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=44615
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
ASTON	88D	NP B301 525	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BERGER	88	ZPHY C37 329	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=40566
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
BOLONKIN	86	SJNP 43 776	B.V. Bolonkin <i>et al.</i>	(ITEP) JP	REFID=44646
		Translated from YAF 43 1211.			
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	83	PL 121B 216	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21408
ARMSTRONG	83B	NP B224 193	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
AGUILAR-...	81B	ZPHY C8 313	M. Aguilar-Benitez <i>et al.</i>	(CERN, CDEF+)	REFID=21104
ALHARRAN	81	NP B191 26	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=21403
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20742
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20737
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20738
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)	REFID=20377
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)	REFID=20378
BARREIRO	77	NP B121 237	F. Barreiro <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=21392
EVANGELIS...	77	NP B127 384	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20540
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL) IJP	REFID=20367
BRANDENB...	76C	NP B104 413	G.W. Brandenburg <i>et al.</i>	(SLAC)	REFID=20225
BEUSCH	75B	PL 60B 101	W. Beusch <i>et al.</i>	(CERN, ETH)	REFID=21390
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
AGUILAR-...	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
AMMAR	67	PRL 19 1071	R. Ammar <i>et al.</i>	(NWES, ANL) JP	REFID=21382
BARNES	67	PRL 19 964	V.E. Barnes <i>et al.</i>	(BNL, SYRA) IJPC	REFID=21383
CRENNELL	66	PRL 16 1025	D.J. Crennell <i>et al.</i>	(BNL) I	REFID=20317

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Seen mostly in antinucleon-nucleon annihilation. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M123

NODE=M123

 $f_2(1565)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M123PP

NODE=M123PP

NODE=M123PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1495–1560) – i (40–110) OUR ESTIMATE			
$(1560 \pm 15) - i (140 \pm 20)$	¹ ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1552 \pm 13) - i (57 \pm 12)$	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \eta \eta,$ $\pi^0 \pi^0 \pi^0$
$(1507 \pm 15) - i (65 \pm 10)$	BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
$(1534 \pm 20) - i (90 \pm 30)$	² ABELE	96C	RVUE Compilation
$(\sim 1552) - i (\sim 71)$	³ AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0,$ $\pi^0 \eta \eta, \pi^0 \pi^0 \eta$

¹ On sheet II in a two-pole solution.

² T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.

³ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

NODE=M123PP;LINKAGE=A

NODE=M123PP;LINKAGE=D

NODE=M123PP;LINKAGE=E

 $f_2(1565)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1571 ± 13 OUR AVERAGE			
[1575 $\pm$ 18 MeV OUR 2023 AVERAGE]			
1575 $\pm$ 18	¹ BERTIN	98	OBLX $0.05\text{--}0.405 \bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1565 $\pm$ 20	¹ MAY	90	ASTE $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1590 $\pm$ 10	AMELIN	06	VES $36 \pi^- p \rightarrow \omega \omega n$
1550 $\pm 10 \pm 20$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1598 $\pm 11 \pm 9$	BAKER	99B	SPEC $0 \bar{p}p \rightarrow \omega \omega \pi^0$
1598 ± 72	BALOSHIN	95	SPEC $40 \pi^- C \rightarrow K_S^0 K_S^0 X$
1566 $^{+80}_{-50}$	² ANISOVICH	94	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0$
1502 ± 9	ADAMO	93	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1488 ± 10	³ ARMSTRONG	93C	E760 $\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1508 ± 10	³ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
1525 ± 10	³ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 1504	⁴ WEIDENAUER	93	ASTE $0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$
1540 ± 15	³ ADAMO	92	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1515 ± 10	⁵ AKER	91	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$
1477 ± 5	BRIDGES	86C	DBC $0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$

¹ Breit-Wigner mass.

² From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

³ J^P not determined, could be partly $f_0(1500)$.

⁴ J^P not determined.

⁵ Superseded by AMSLER 95B.

NODE=M123M

NODE=M123M

NEW

OCCUR=2

NODE=M123M;LINKAGE=G

NODE=M123M;LINKAGE=C

NODE=M123M;LINKAGE=E

NODE=M123M;LINKAGE=F

NODE=M123M;LINKAGE=BA

 $f_2(1565)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
132 ± 23 OUR AVERAGE			
Error includes scale factor of 1.1. [119 $\pm$ 24 MeV OUR 2023 AVERAGE]			
119 ± 24	¹ BERTIN	98	OBLX $0.05\text{--}0.405 \bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
170 ± 40	¹ MAY	90	ASTE $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$

NODE=M123W

NODE=M123W

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

140 ± 11	^{1,2} AMELIN	06	VES	$36 \pi^- p \rightarrow \omega \omega n$
$130 \pm 20 \pm 40$	¹ AMELIN	00	VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
263 ± 101	BALOSHIN	95	SPEC	$40 \pi^- C \rightarrow K_S^0 K_S^0 X$
166^{+80}_{-20}	³ ANISOVICH	94	CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0, \eta \eta \pi^0$
130 ± 10	⁴ ADAMO	93	OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
148 ± 27	⁵ ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
103 ± 15	⁵ ARMSTRONG	93D	E760	$\bar{p} p \rightarrow 3\pi^0 \rightarrow 6\gamma$
111 ± 10	⁵ ARMSTRONG	93D	E760	$\bar{p} p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 206	⁶ WEIDENAUER	93	ASTE	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$
132 ± 37	⁵ ADAMO	92	OBLX	$\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
120 ± 10	⁷ AKER	91	CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$
116 ± 9	BRIDGES	86C	DBC	$0.0 \bar{p} N \rightarrow 3\pi^- 2\pi^+$

¹ Breit-Wigner width.

² Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.

³ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

⁴ Supersedes ADAMO 92.

⁵ J^P not determined, could be partly $f_0(1500)$.

⁶ J^P not determined.

⁷ Superseded by AMSLER 95B.

OCCUR=2

NODE=M123W;LINKAGE=G
 NODE=M123W;LINKAGE=AM
 NODE=M123W;LINKAGE=D
 NODE=M123W;LINKAGE=C
 NODE=M123W;LINKAGE=E
 NODE=M123W;LINKAGE=F
 NODE=M123W;LINKAGE=BA

$f_2(1565)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi \pi$	seen
$\Gamma_2 \quad \pi^+ \pi^-$	seen
$\Gamma_3 \quad \pi^0 \pi^0$	seen
$\Gamma_4 \quad \rho^0 \rho^0$	seen
$\Gamma_5 \quad 2\pi^+ 2\pi^-$	seen
$\Gamma_6 \quad \eta \eta$	seen
$\Gamma_7 \quad \omega \omega$	seen
$\Gamma_8 \quad K \bar{K}$	seen
$\Gamma_9 \quad \gamma \gamma$	seen

NODE=M123215;NODE=M123

DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←

$f_2(1565)$ PARTIAL WIDTHS

$\Gamma(\eta\eta)$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.2 ± 0.3	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

Γ_6

NODE=M123225

NODE=M123W3
 NODE=M123W3

NODE=M123W3;LINKAGE=SC

$\Gamma(K\bar{K})$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.0 ± 1.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

Γ_8

NODE=M123W1
 NODE=M123W1

NODE=M123W1;LINKAGE=SC

$\Gamma(\gamma\gamma)$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.70 ± 0.14	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV, using $f_2(1565)$ mass of 1570 MeV, width of 160 MeV, $\Gamma(\pi\pi) = 25$ MeV, and SU(3) relations.

Γ_9

NODE=M123W2
 NODE=M123W2

NODE=M123W2;LINKAGE=SC

$f_2(1565)$ BRANCHING RATIOS

NODE=M123220

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	BAKER	99B	SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$

NODE=M123R5
NODE=M123R5

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	BERTIN	98	OBLX	$0.05\text{--}0.405 \bar{n} p \rightarrow \pi^+\pi^+\pi^-$
not seen	¹ ANISOVICH	94B	RVUE	$\bar{p} p \rightarrow \pi^+\pi^-\pi^0$
seen	MAY	89	ASTE	$\bar{p} p \rightarrow \pi^+\pi^-\pi^0$

NODE=M123R1
NODE=M123R1¹ ANISOVICH 94B is from a reanalysis of MAY 90.

NODE=M123R1;LINKAGE=A

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AMSLER	95B	CBAR	$0.0 \bar{p} p \rightarrow 3\pi^0$

NODE=M123R3
NODE=M123R3

$\Gamma(\pi^+\pi^-)/\Gamma(\rho^0\rho^0)$				Γ_2/Γ_4
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.042 ± 0.013	BRIDGES	86B	DBC	$\bar{p} N \rightarrow 3\pi^- 2\pi^+$

NODE=M123R2
NODE=M123R2

$\Gamma(\eta\eta)/\Gamma(\pi^0\pi^0)$				Γ_6/Γ_3
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.024 \pm 0.005 \pm 0.012$	¹ ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
¹ J^P not determined, could be partly $f_0(1500)$.				

NODE=M123R4
NODE=M123R4

NODE=M123R4;LINKAGE=E

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$				Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	BAKER	99B	SPEC	$0 \bar{p} p \rightarrow \omega \omega \pi^0$

NODE=M123R6
NODE=M123R6 **$f_2(1565)$ REFERENCES**

NODE=M123

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
Translated from YAF 69 715.				
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
BAKER	99B	PL B467 147	C.A. Baker <i>et al.</i>	
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
ABELE	96C	NP A609 562	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95C	PL B353 571	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)
Translated from YAF 58 50.				
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94	PL B323 233	V.V. Anisovich <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	94B	PR D50 1972	V.V. Anisovich <i>et al.</i>	(LOQM)
ADAMO	93	NP A558 13C	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)
ADAMO	92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)
MAY	90	ZPHY C46 203	B. May <i>et al.</i>	(ASTERIX Collab.)
MAY	89	PL B225 450	B. May <i>et al.</i>	(ASTERIX Collab.) IJP
BRIDGES	86B	PRL 56 215	D.L. Bridges <i>et al.</i>	(SYRA, CASE)
BRIDGES	86C	PRL 57 1534	D.L. Bridges <i>et al.</i>	(SYRA)

REFID=52719
REFID=51574REFID=51185
REFID=48580
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REFID=43585
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REFID=42172
REFID=41587
REFID=41365
REFID=40921
REFID=21376
REFID=21377

$\rho(1570)$

$$J^{PC} = 1^{++}$$

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M188

NODE=M188

 $\rho(1570)$ MASS

NODE=M188M

NODE=M188M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1570±36±62	54	¹ AUBERT	08s BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1614± 2		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
1585±15		³ ACHASOV	20C SND	1.3–2.0 $e^+e^- \rightarrow K^+K^-\pi^0$
1480±40		⁴ BITYUKOV	87 SPEC	32.5 $\pi^-p \rightarrow \phi\pi^0n$

¹ From the fit with two resonances.² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.³ From a fit using a two resonance model in which the mass and width of the other resonance are fixed at the $\rho(1700)$ values from PDG 20.⁴ Systematic errors not estimated.

NODE=M188M;LINKAGE=AU

NODE=M188M;LINKAGE=B

NODE=M188M;LINKAGE=A

NODE=M188M;LINKAGE=BI

 $\rho(1570)$ WIDTH

NODE=M188W

NODE=M188W

NEW

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
140±90 OUR AVERAGE		[144 ± 90 MeV OUR 2023 AVERAGE]		
144±75±43	54	¹ AUBERT	08s BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
492± 4		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
75±30		³ ACHASOV	20C SND	1.3–2.0 $e^+e^- \rightarrow K^+K^-\pi^0$
130±60		⁴ BITYUKOV	87 SPEC	32.5 $\pi^-p \rightarrow \phi\pi^0n$

¹ From the fit with two resonances.² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.³ From a fit using a two resonance model in which the mass and width of the other resonance are fixed at the $\rho(1700)$ values from PDG 20.⁴ Systematic errors not estimated.

NODE=M188W;LINKAGE=AU

NODE=M188W;LINKAGE=B

NODE=M188W;LINKAGE=A

NODE=M188W;LINKAGE=BI

 $\rho(1570)$ DECAY MODES

NODE=M188215;NODE=M188

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	seen
Γ_2 $\phi\pi$	not seen
Γ_3 $\omega\pi$	

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=3

 $\rho(1570)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M188225

$\Gamma(\phi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$						$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT	
3.5±0.9±0.3		54	¹ AUBERT	08s	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
<70	90		² AULCHENKO	87B	ND	$e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$

¹ From the fit with two resonances.² Using mass and width of BITYUKOV 87.

NODE=M188G01;LINKAGE=AU

NODE=M188G01;LINKAGE=AL

 $\rho(1570)$ BRANCHING RATIOS

NODE=M188220

$\Gamma(\phi\pi)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	ABELE	97H	CBAR	$\bar{p}p \rightarrow K_L^0 K_S^0 \pi^0 \pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<0.01	¹ DONNACHIE	91	RVUE	

¹ Using data from BISELLO 91B, DOLINSKY 86, and ALBRECHT 87L.

NODE=M188R01

NODE=M188R01

NODE=M188R01;LINKAGE=DO

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$					Γ_2/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.5	95	BITYUKOV	87	SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$

NODE=M188R02
NODE=M188R02

$\rho(1570)$ REFERENCES

NODE=M188

ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	20C	EPJ C80 1139	M.N. Achasov <i>et al.</i>	(SND Collab.)
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABELE	97H	PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AULCHENKO	87B	JETPL 45 145	V.M. Aulchenko <i>et al.</i>	(NOVO)
		Translated from ZETFP 45 118.		
BITYUKOV	87	PL B188 383	S.I. Bityukov <i>et al.</i>	(SERP)
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)

REFID=62428
REFID=61028
REFID=60935
REFID=60676
REFID=58311
REFID=52242
REFID=45765
REFID=41752
REFID=41632
REFID=40418
REFID=41373

REFID=40011
REFID=20246

$h_1(1595)$

$I^G(J^{PC}) = 0^-(1^{+-})$

OMITTED FROM SUMMARY TABLE
Seen in a partial-wave analysis of the $\omega\eta$ system produced in the reaction $\pi^- p \rightarrow \omega\eta n$ at 18 GeV/c.

NODE=M166

NODE=M166

$h_1(1595)$ MASS

NODE=M166M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01	SPEC $18 \pi^- p \rightarrow \omega\eta n$

NODE=M166M

$h_1(1595)$ WIDTH

NODE=M166W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
380^{+90}_{-120} OUR AVERAGE	[384^{+90}_{-120} MeV OUR 2023 AVERAGE]		
$384 \pm 60^{+70}_{-100}$	EUGENIO	01	SPEC $18 \pi^- p \rightarrow \omega\eta n$

NODE=M166W

NEW

$h_1(1595)$ DECAY MODES

NODE=M166215;NODE=M166

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\eta$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

$h_1(1595)$ REFERENCES

NODE=M166

EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>

REFID=48010

$\pi_1(1600)$

$$I^G(J^{PC}) = 1^-(1^-+)$$

Coupled channel analyses favor the existence of only one broad 1^-+ isovector state consistent with $\pi_1(1600)$ in the 1400–1600 MeV region. Accordingly, the $\pi_1(1400)$ entries of the previous Reviews have been moved into this section. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M164

NODE=M164

 $\pi_1(1600)$ T-Matrix Pole $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1480–1680) – i (150–300) OUR ESTIMATE			
$(1623 \pm 47^{+24}_{-75}) - i(228 \pm 44^{+72}_{-88})$	¹ KOPF	21	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$, $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$ and $191 \pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$
$(1564 \pm 24 \pm 86) - i(246 \pm 27 \pm 51)$	² RODAS	19	RVUE $191 \pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1405 \pm 4^{+15}_{-18}) - i(314 \pm 14^{+18}_{-69})$	³ ALBRECHT	20	RVUE $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\bar{K}$ systems.			
² The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data.			
³ Superseded by KOPF 21.			

NODE=M164TMP

NODE=M164TMP

NODE=M164TMP

→ UNCHECKED ←

NODE=M164TMP;LINKAGE=B

NODE=M164TMP;LINKAGE=A
NODE=M164TMP;LINKAGE=AL

 $\pi_1(1600)$ MASS ($\eta\pi$ mode)

Not seen by PROKOSHKIN 95B, BUGG 94, APEL 81, BOUTEMEUR 90, and AGHASYAN 18B.

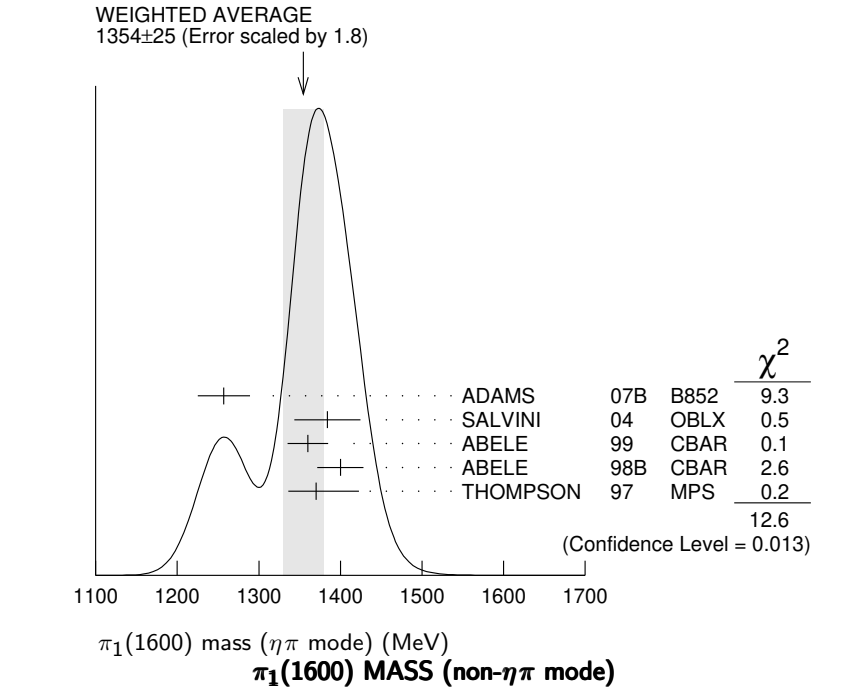
NODE=M164MEP

NODE=M164MEP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1354 ±25	OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.			
1257 ±20 ±25	23.5k	ADAMS	07B	B852	$18 \pi^- p \rightarrow \eta \pi^0 n$
1384 ±20 ±35	90k	SALVINI	04	OBLX	$\bar{p}p \rightarrow 2\pi^+ 2\pi^-$
1360 ±25		ABELE	99	CBAR	$0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1400 ±20 ±20		ABELE	98B	CBAR	$0.0 \bar{p}n \rightarrow \pi^- \pi^0 \eta$
1370 ±16 $^{+50}_{-30}$		¹ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1323.1 ± 4.6		² AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
1406 ±20		³ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$
¹ Natural parity exchange, questioned by DZIERBA 03.					
² Unnatural parity exchange.					
³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.					

NODE=M164MEP

NODE=M164MEP;LINKAGE=B
NODE=M164MEP;LINKAGE=C
NODE=M164MEP;LINKAGE=A



NODE=M164M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1645⁺⁴⁰₋₁₇	OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
[1661 ⁺¹⁵ ₋₁₁	MeV	OUR 2023 AVERAGE Scale factor = 1.2]		

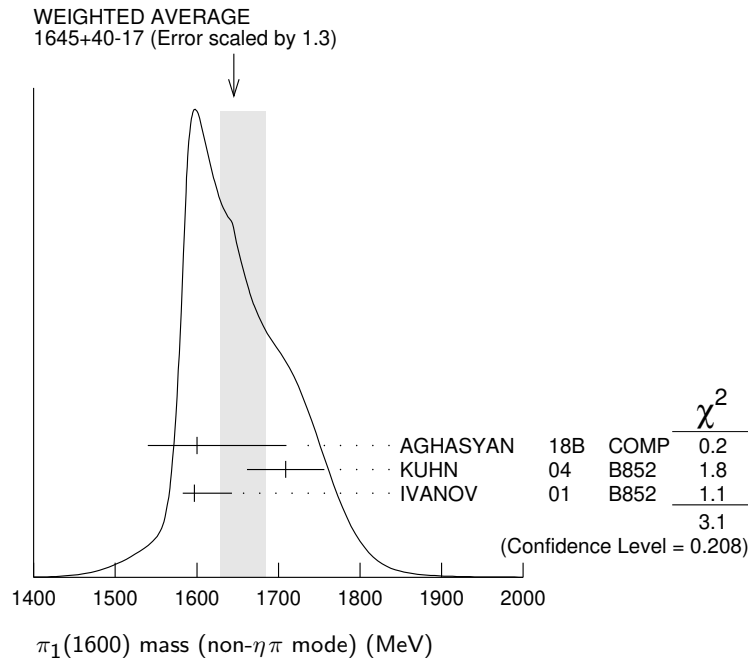
NODE=M164M

NEW

1600 ⁺¹¹⁰ ₋₆₀	46M	¹ AGHASYAN	18B	COMP	190	$\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1709 ± 24 ± 41	69k	² KUHN	04	B852	18	$\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1597 ± 10 ⁺⁴⁵ ₋₁₀		² IVANOV	01	B852	18	$\pi^- p \rightarrow \eta' \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1660 ± 10 ⁺⁰ ₋₆₄	420k	³ ALEKSEEV	10	COMP	190	$\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1664 ± 8 ± 10	145k	⁴ LU	05	B852	18	$\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1593 ± 8 ⁺²⁹ ₋₄₇		^{2,5} ADAMS	98B	B852	18.3	$\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M164M;LINKAGE=B
NODE=M164M;LINKAGE=A
NODE=M164M;LINKAGE=C
NODE=M164M;LINKAGE=LU
NODE=M164M;LINKAGE=DZ

¹ Statistical error negligible. See also the review ALEXEEV 22.
² Natural parity exchange.
³ Superseded by AGHASYAN 2018B.
⁴ May be a different state: natural and unnatural parity exchanges.
⁵ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.



$\pi_1(1600)$ WIDTH ($\eta\pi$ mode)

Not seen by PROKOSHIN 95B, BUGG 94, APEL 81, BOUTEMEUR 90, and AGHASYAN 18B.

NODE=M164WEP

NODE=M164WEP

NODE=M164WEP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 $\pm$ 35	OUR AVERAGE				
354 $\pm$ 64 $\pm$ 58	23.5k	ADAMS	07B	B852	18 $\pi^- p \rightarrow \eta \pi^0 n$
378 $\pm$ 50 $\pm$ 50	90k	SALVINI	04	OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
220 $\pm$ 90		ABELE	99	CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
310 $\pm$ 50 $\pm$ 50		ABELE	98B	CBAR	0.0 $\bar{p} n \rightarrow \pi^- \pi^0 \eta$
385 $\pm$ 40 $\pm$ 65		1 THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
143.2 $\pm$ 12.5		2 AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
180 $\pm$ 20		3 ALDE	88B	GAM4 0	100 $\pi^- p \rightarrow \eta \pi^0 n$

¹ Resolution is not unfolded, natural parity exchange, questioned by DZIERBA 03.

² Unnatural parity exchange.

³ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

$\pi_1(1600)$ WIDTH (non- $\eta\pi$ mode)

NODE=M164WEP;LINKAGE=QQ

NODE=M164WEP;LINKAGE=C

NODE=M164WEP;LINKAGE=A

NODE=M164W

NODE=M164W

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
370 $\pm$ 50	OUR AVERAGE			
370 $\pm$ 50	OUR AVERAGE			
[240 $\pm$ 50 MeV OUR 2023 AVERAGE Scale factor = 1.7]				
580 $\pm$ 100 $\pm$ 230	46M	1 AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
403 $\pm$ 80 $\pm$ 115	69k	2 KUHN	04	B852 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
340 $\pm$ 40 $\pm$ 50		2 IVANOV	01	B852 18 $\pi^- p \rightarrow \eta' \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
269 $\pm$ 21 $\pm$ 42	420k	3 ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
185 $\pm$ 25 $\pm$ 28	145k	4 LU	05	B852 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
168 $\pm$ 20 $\pm$ 150		2.5 ADAMS	98B	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ Statistical error negligible. See also the review ALEXEEV 22.

² Natural parity exchange.

³ Superseded by AGHASYAN 2018B.

⁴ May be a different state: natural and unnatural parity exchanges.

⁵ Superseded by DZIERBA 06 excluding this state in a more refined PWA analysis, with 2.6 M events of $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data.

NODE=M164W;LINKAGE=B

NODE=M164W;LINKAGE=A

NODE=M164W;LINKAGE=C

NODE=M164W;LINKAGE=LU

NODE=M164W;LINKAGE=DZ

$\pi_1(1600)$ DECAY MODES

NODE=M164215;NODE=M164

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi\pi$	seen
$\Gamma_2 \quad \rho^0\pi^-$	seen
$\Gamma_3 \quad f_2(1270)\pi^-$	not seen
$\Gamma_4 \quad b_1(1235)\pi$	seen
$\Gamma_5 \quad \eta'(958)\pi^-$	seen
$\Gamma_6 \quad \eta\pi$	seen
$\Gamma_7 \quad f_1(1285)\pi$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=4

DESIG=5

DESIG=3

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

 $\pi_1(1600)$ BRANCHING RATIOS

NODE=M164220

 $\Gamma(\rho^0\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen ALEKSEEV 10 COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen NOZAR 09 CLAS $\gamma p \rightarrow 2\pi^+ \pi^- n$

not seen ¹ DZIERBA 06 B852 18 $\pi^- p$

¹ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes ADAMS 98B.

NODE=M164R1

NODE=M164R1

NODE=M164R1;LINKAGE=DZ

 $\Gamma(f_2(1270)\pi^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ¹ DZIERBA 06 B852 18 $\pi^- p$

¹ From the PWA analysis of 2.6 M $\pi^- p \rightarrow \pi^- \pi^- \pi^+ p$ and 3 M events of $\pi^- p \rightarrow \pi^- \pi^0 \pi^0 p$ of E852 data. Supersedes CHUNG 02.

NODE=M164R3

NODE=M164R3

NODE=M164R3;LINKAGE=DZ

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

seen 35280 ¹ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+\pi^-\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 145k LU 05 B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$

¹ $B((b_1\pi)_{D\text{-wave}})/B((b_1\pi)_{S\text{-wave}})=0.3 \pm 0.1$.

NODE=M164R4

NODE=M164R4

NODE=M164R;LINKAGE=RB

 $\Gamma(\eta'(958)\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen IVANOV 01 B852 18 $\pi^- p \rightarrow \eta'\pi^- p$

NODE=M164R2

NODE=M164R2

 $\Gamma(\eta'(958)\pi^-)/\Gamma(\eta\pi)$ Γ_5/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.54 \pm 1.1^{+1.8}_{-0.27}$ ¹ KOPF 21 RVUE 0.9 $p\bar{p} \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$
 $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$
 $\pi^- \pi^- \pi^+ p$

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

NODE=M164R00

NODE=M164R00

NODE=M164R00;LINKAGE=A

 $\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$ Γ_7/Γ_5

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

3.80 ± 0.78 69k ¹ KUHN 04 B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

¹ Using $\eta'(958)\pi$ data from IVANOV 01.

NODE=M164R5

NODE=M164R5

NODE=M164R;LINKAGE=KU

$\pi_1(1600)$ REFERENCES

ALEXEEV	22	PR D105 012005	G.D. Alexeev <i>et al.</i>	(COMPASS Collab.)
KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
NOZAR	09	PRL 102 102002	M. Nozar <i>et al.</i>	(JLab CLAS Collab.)
ADAMS	07B	PL B657 27	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
SALVINI	04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
BAKER	03	PL B563 140	C.A. Baker <i>et al.</i>	
DZIERBA	03	PR D67 094015	A.R. Dzierba <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
ABELE	99	PL B446 349	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	98B	PL B423 175	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)
PROKOSHKIN	95B	PAN 58 606	Y.D. Prokoshkin, S.A. Sadovsky	(SERP)
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)
BOUTEMEUR	90	Hadron 89 Conf. p 119	M. Boutemur, M. Poulet	(SERP, BELG, LANL+)
ALDE	88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
APEL	81	NP B193 269	W.D. Apel <i>et al.</i>	(SERP, CERN)

NODE=M164

REFID=61491
REFID=61470
REFID=60439
REFID=59554
REFID=59471
REFID=56385
REFID=53356
REFID=52758
REFID=52048
REFID=51077
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REFID=49414
REFID=49412
REFID=48837
REFID=48317
REFID=46602
REFID=45864
REFID=46610
REFID=45584
REFID=44619

REFID=44078
REFID=43599
REFID=41751
REFID=40558
REFID=22913

 $a_1(1640)$

$$I^G(J^{PC}) = 1^-(1^{++})$$

Possibly seen in the study of the hadronic structure in decay $\tau \rightarrow 3\pi\nu_\tau$ (ABREU 98G and ASNER 00).

NODE=M161

NODE=M161

 $a_1(1640)$ MASS

NODE=M161M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1655 ± 16 OUR AVERAGE		Error includes scale factor of 1.2.		
1700 ⁺³⁵ ₋₁₃₀	46M	¹ AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1691 ± 18 ± 30		DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1630 ± 20	35k	² BAKER	03	SPEC $\bar{p} p \rightarrow \omega \pi^+ \pi^- \pi^0$
1714 ± 9 ± 36		CHUNG	02	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1640 ± 12 ± 30		BAKER	99	SPEC 1.94 $\bar{p} p \rightarrow 4\pi^0$
1670 ± 90		BELLINI	85	SPEC 40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Statistical error negligible.

² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161M;LINKAGE=A

NODE=M161M;LINKAGE=KB

 $a_1(1640)$ WIDTH

NODE=M161W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250± 40 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.				
[254 ± 40 MeV OUR 2023 AVERAGE Scale factor = 1.8]				
510 ⁺¹⁷⁰ ₋₉₀	46M	¹ AGHASYAN	18B	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
171± 33±40		DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
225± 30	35k	² BAKER	03	SPEC $\bar{p} p \rightarrow \omega \pi^+ \pi^- \pi^0$
308± 37±62		CHUNG	02	B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
300± 22±40		BAKER	99	SPEC 1.94 $\bar{p} p \rightarrow 4\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
300±100		BELLINI	85	SPEC 40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

• • • We do not use the following data for averages, fits, limits, etc. • • •

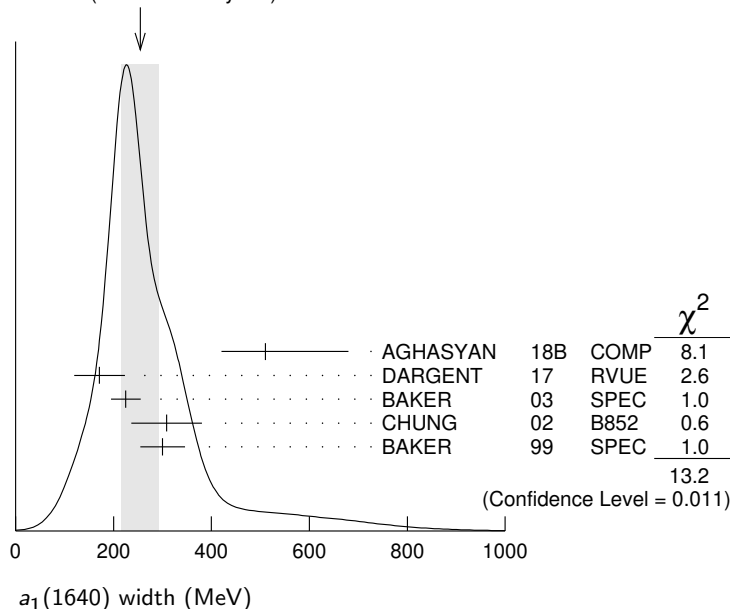
NODE=M161W

NEW

¹ Statistical error negligible.² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161W;LINKAGE=A

NODE=M161W;LINKAGE=KB

WEIGHTED AVERAGE
250±40 (Error scaled by 1.8) **$a_1(1640)$ DECAY MODES**

NODE=M161215;NODE=M161

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi\pi$	seen
Γ_2 $f_2(1270)\pi$	seen
Γ_3 $\sigma\pi$	seen
Γ_4 $\rho\pi$ S-wave	seen
Γ_5 $\rho\pi$ D-wave	seen
Γ_6 $\omega\pi\pi$	seen
Γ_7 $f_1(1285)\pi$	seen
Γ_8 $a_1(1260)\eta$	not seen

DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8

 $a_1(1640)$ BRANCHING RATIOS

NODE=M161220

$\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$	Γ_2/Γ_3
VALUE	DOCUMENT ID TECN COMMENT
0.24±0.07	BAKER 99 SPEC 1.94 $\bar{p}p \rightarrow 4\pi^0$

NODE=M161R1
 NODE=M161R1

$\Gamma(\rho\pi$ D-wave)/ Γ_{total}	Γ_5/Γ
VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	CHUNG 02 B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
seen	AMELIN 95B VES 36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M161R2
 NODE=M161R2

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	EVTS DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	35280 ¹ BAKER 03 SPEC $\bar{p}p \rightarrow \omega\pi^+ \pi^- \pi^0$

NODE=M161R3
 NODE=M161R3

¹ Assuming the $\omega\rho$ mechanism for the $\omega\pi\pi$ state.

NODE=M161R;LINKAGE=KB

$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$	Γ_7/Γ
VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen	KUHN 04 B852 18 $\pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$
seen	LEE 94 MPS2 18 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

NODE=M161R4
 NODE=M161R4

$\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$				Γ_8/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$	

NODE=M161R5
NODE=M161R5

$a_1(1640)$ REFERENCES

AGHASYAN 18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
DARGENT 17	JHEP 1705 143	P. dArgent <i>et al.</i>	(HEID, BRIS)
KUHN 04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
BAKER 03	PL B563 140	C.A. Baker <i>et al.</i>	
CHUNG 02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ASNER 00	PR D61 012002	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BAKER 99	PL B449 114	C.A. Baker <i>et al.</i>	
ABREU 98G	PL B426 411	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AMELIN 95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
LEE 94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)
BOWLER 88	PL B209 99	M.G. Bowler	(OXF)
BELLINI 85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223.			

NODE=M161

REFID=59471
REFID=58121
REFID=49773
REFID=49414
REFID=48837
REFID=47339
REFID=46888
REFID=45909
REFID=44433
REFID=44092
REFID=40578
REFID=47490

NODE=M117

$f_2(1640)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE

$f_2(1640)$ MASS

NODE=M117M

NODE=M117M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1639 ± 6 OUR AVERAGE	Error includes scale factor of 1.2.		
1620 ± 16	BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1647 ± 7	ADAMO	92 OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
1635 ± 7	ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega \omega n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1640 ± 5	AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
1659 ± 6	VLADIMIRSK...06	SPEC 40	$\pi^- p \rightarrow K_S^0 K_S^0 n$
1643 ± 7	¹ ALDE	89B GAM2	$38 \pi^- p \rightarrow \omega \omega n$
¹ Superseded by ALDE 90.			

NODE=M117M;LINKAGE=BB

$f_2(1640)$ WIDTH

NODE=M117W

NODE=M117W

NEW

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
100⁺⁶⁰₋₄₀ OUR AVERAGE		Error includes scale factor of 2.9.		[99 ⁺⁶⁰ ₋₄₀ MeV OUR 2023
AVERAGE Scale factor = 2.9]				
140 ⁺⁶⁰ ₋₂₀		BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
58±20		ADAMO	92 OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
44± 9		AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
152±18		VLADIMIRSK...06	SPEC 40	$\pi^- p \rightarrow K_S^0 K_S^0 n$
< 70	90	ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega \omega n$

$f_2(1640)$ DECAY MODES

NODE=M117215;NODE=M117

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega \omega$	seen
$\Gamma_2 \quad 4\pi$	seen
$\Gamma_3 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3

$f_2(1640)$ BRANCHING RATIOS

NODE=M117220

NODE=M117R2
NODE=M117R2

$\Gamma(K \bar{K})/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AMSLER	06 CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$	

$f_2(1640)$ REFERENCES

NODE=M117

AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
Translated from YAF 69 515			
BUGG 95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH) JP
ADAMO 92	PL B287 368	A. Adamo <i>et al.</i>	(OBELIX Collab.)
ALDE 90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE 89B	PL B216 451	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+) IGJPC

REFID=51136
REFID=51191

REFID=44438
REFID=42177
REFID=40935
REFID=40735

$\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M154

 $\eta_2(1645)$ MASS

NODE=M154M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1617± 5 OUR AVERAGE				
1613± 8	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1617± 8	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
1620±20	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1645±14±15	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1645± 6±20	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154M

 $\eta_2(1645)$ WIDTH

NODE=M154W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
181±11 OUR AVERAGE				
185±17	BARBERIS	00B		450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
177±18	BARBERIS	00C		450 $pp \rightarrow p_f 4\pi p_s$
180±25	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
180 ⁺⁴⁰ ₋₂₁ ±25	ADOMEIT	96	CBAR 0	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200±25	ANISOVICH	00E	SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

NODE=M154W

 $\eta_2(1645)$ DECAY MODES

NODE=M154215;NODE=M154

Mode	Fraction (Γ_i/Γ)
Γ_1 $a_2(1320)\pi$	seen
Γ_2 $K\bar{K}\pi$	seen
Γ_3 $K^*\bar{K}$	seen
Γ_4 $\eta\pi^+\pi^-$	seen
Γ_5 $a_0(980)\pi$	seen
Γ_6 $f_2(1270)\eta$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←

 $\eta_2(1645)$ BRANCHING RATIOS

NODE=M154220

$\Gamma(K\bar{K}\pi)/\Gamma(a_2(1320)\pi)$	Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.07±0.03	¹ BARBERIS	97C	OMEG 450 $pp \rightarrow ppK\bar{K}\pi$

NODE=M154R1
 NODE=M154R1

¹ Using $2(\pi^+\pi^-)$ data from BARBERIS 97B.

NODE=M154R1;LINKAGE=A

$\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$				Γ_1/Γ_5
VALUE	DOCUMENT ID	TECN	COMMENT	
13.1±2.3 OUR AVERAGE				
13.5±4.6	² ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$
13.0±2.7	BARBERIS	00B	450	$pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M154R3
 NODE=M154R3

² Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M154R3;LINKAGE=AN

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE	DOCUMENT ID	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
not seen	BARBERIS	00B 450	$pp \rightarrow p_f \eta \pi^+ \pi^- p_s$	

NODE=M154R4
 NODE=M154R4

 $\eta_2(1645)$ REFERENCES

NODE=M154

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)

REFID=53631
 REFID=47945
 REFID=47958
 REFID=47959
 REFID=45758
 REFID=45759
 REFID=45202

$\omega(1650)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

See also the $\omega(1420)$ particle listing.

NODE=M126

NODE=M126

NODE=M126M

NODE=M126M

→ UNCHECKED ←

 $\omega(1650)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1670 ± 30 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1660.0 ± 8.4		¹ LICHARD	23 RVUE	$e^+e^- \rightarrow \omega\eta$
1698 ± 10	267	² ACHASOV	20B SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
1651 ± 3 $^{+16}_{-6}$	183k	³ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+K^-\pi^0$
1673 $^{+6}_{-7}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
1671 ± 6 ± 10	824	⁴ AKHMETSHIN	17A CMD3	$1.4\text{--}2.0 e^+e^- \rightarrow \omega\eta$
1660 ± 10	898	⁵ ACHASOV	16B SND	$1.34\text{--}2.00 e^+e^- \rightarrow \omega\eta$
1680 ± 10	13.1k	⁶ AULCHENKO	15A SND	$1.05\text{--}1.80 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1667 ± 13 ± 6		AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
1645 ± 8	13	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow \omega\eta\gamma$
1660 ± 10 ± 2		AUBERT,B	04N BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
1770 ± 50 ± 60	1.2M	⁷ ACHASOV	03D RVUE	$0.44\text{--}2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1619 ± 5		⁸ HENNER	02 RVUE	$1.2\text{--}2.0 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1700 ± 20		EUGENIO	01 SPEC	$18 \pi^-\rho \rightarrow \omega\eta n$
1705 ± 26	612	⁹ AKHMETSHIN	00D CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1820 $^{+190}_{-150}$		¹⁰ ACHASOV	98H RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1840 $^{+100}_{-70}$		¹¹ ACHASOV	98H RVUE	$e^+e^- \rightarrow \omega\pi^+\pi^-$
1780 $^{+170}_{-300}$		¹² ACHASOV	98H RVUE	$e^+e^- \rightarrow K^+K^-$
~ 2100		¹³ ACHASOV	98H RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1606 ± 9		¹⁴ CLEGG	94 RVUE	
1662 ± 13	750	¹⁵ ANTONELLI	92 DM2	$1.34\text{--}2.4 e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
1670 ± 20		ATKINSON	83B OMEG	$20\text{--}70 \gamma p \rightarrow 3\pi X$
1657 ± 13		CORDIER	81 DM1	$e^+e^- \rightarrow \omega 2\pi$
1679 ± 34	21	ESPOSITO	80 FRAM	$e^+e^- \rightarrow 3\pi$
1652 ± 17		COSME	79 OSPK	$e^+e^- \rightarrow 3\pi$

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=4

¹ From a VDM fit to AKHMETSHIN 17A $\omega\eta$ data with two additional resonances of low statistical evidences.

² From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in 1694 ± 9 MeV measurement.

³ Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

⁴ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.

⁵ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁶ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

⁷ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁸ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

⁹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

¹⁰ Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

¹¹ Using the data from ANTONELLI 92.

¹² Using the data from IVANOV 81 and BISELLO 88B.

¹³ Using the data from BISELLO 91C.

¹⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

NODE=M126M;LINKAGE=J

NODE=M126M;LINKAGE=H

NODE=M126M;LINKAGE=G

NODE=M126M;LINKAGE=F

NODE=M126M;LINKAGE=E

NODE=M126M;LINKAGE=A

NODE=M126M;LINKAGE=VH

NODE=M126M;LINKAGE=AB

NODE=M126M;LINKAGE=KI

NODE=M126M;LINKAGE=L1

NODE=M126M;LINKAGE=L2

NODE=M126M;LINKAGE=L3

NODE=M126M;LINKAGE=L4

NODE=M126M;LINKAGE=AD

¹⁵ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

$\omega(1650)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
315 ± 35 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
106 ± 15		¹ LICHARD 23	RVUE	$e^+e^- \rightarrow \omega\eta$
110 ± 16	267	² ACHASOV 20B	SND	$e^+e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
194 ± 8 ⁺ ₇ 15 ⁺ ₇	183k	³ ABLIKIM 19AQ	BES	$J/\psi \rightarrow K^+K^-\pi^0$
95 ± 11		ACHASOV 19	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
113 ± 9 ± 10	824	⁴ AKHMETSHIN 17A	CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
110 ± 20	898	⁵ ACHASOV 16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
310 ± 30	13.1k	⁶ AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
222 ± 25 ± 20		AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
114 ± 14	13	AUBERT 06D	BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
230 ± 30 ± 20		AUBERT,B 04N	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
490 ⁺ ₁₅₀ ± 200 ± 130	1.2M	⁷ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
250 ± 14		⁸ HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
250 ± 50		EUGENIO 01	SPEC	18 $\pi^-p \rightarrow \omega\eta n$
370 ± 25	612	⁹ AKHMETSHIN 00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
113 ± 20		¹⁰ CLEGG 94	RVUE	
280 ± 24	750	¹¹ ANTONELLI 92	DM2	1.34–2.4 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
160 ± 20		ATKINSON 83B	OMEG	20–70 $\gamma p \rightarrow 3\pi X$
136 ± 46		CORDIER 81	DM1	$e^+e^- \rightarrow \omega 2\pi$
99 ± 49	21	ESPOSITO 80	FRAM	$e^+e^- \rightarrow 3\pi$
42 ± 17		COSME 79	OSPK	$e^+e^- \rightarrow 3\pi$

¹ From a VDM fit to AKHMETSHIN 17A $\omega\eta$ data with two additional resonances of low statistical evidences.

² From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in 94 ± 13 MeV measurement.

³ Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

⁴ From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating.

⁵ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁶ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+\pi^-\pi^0$ data.

⁷ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+\pi^-\pi^0$ and ANTONELLI 92 on the $\omega\pi^+\pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁸ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.

⁹ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

¹⁰ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹¹ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

$\omega(1650)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\rho(1450)\pi$	seen
Γ_3 $\omega\pi\pi$	seen
Γ_4 $\omega\eta$	seen
Γ_5 e^+e^-	seen
Γ_6 $\pi^0\gamma$	not seen

NODE=M126M;LINKAGE=AE

NODE=M126W

NODE=M126W
→ UNCHECKED ←

OCCUR=2
OCCUR=5
OCCUR=4

NODE=M126W;LINKAGE=J

NODE=M126W;LINKAGE=H

NODE=M126W;LINKAGE=G

NODE=M126W;LINKAGE=F

NODE=M126W;LINKAGE=E
NODE=M126W;LINKAGE=A

NODE=M126W;LINKAGE=VH

NODE=M126W;LINKAGE=AB

NODE=M126W;LINKAGE=KI

NODE=M126W;LINKAGE=AD

NODE=M126W;LINKAGE=AE

NODE=M126215;NODE=M126

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=5

$\omega(1650) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M126230

 $\Gamma(\rho\pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 / \Gamma \times \Gamma_5 / \Gamma$ NODE=M126G3
NODE=M126G3

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.56 ± 0.23	13.1k	¹ AULCHENKO	15A SND	1.05–1.80 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3 ± 0.1 ± 0.1		AUBERT,B	04N BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$
1.2 ± 0.4 ± 0.8 ± 0.1	1.2M	^{2,3} ACHASOV	03D RVUE	0.44–2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
0.921 ± 0.230		^{4,5} CLEGG	94 RVUE	
0.479 ± 0.050	750	^{6,7} ANTONELLI	92 DM2	1.34–2.4 $e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$. See ACHASOV 20A for a further analysis of the $\pi^+ \pi^- \pi^0$ data.

² Calculated by us from the cross section at the peak.

³ From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega \pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁵ From the partial and leptonic width given by the authors.

⁶ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

⁷ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M126G3;LINKAGE=A

NODE=M126G;LINKAGE=AW
NODE=M126G;LINKAGE=VH

NODE=M126G;LINKAGE=AD

NODE=M126G;LINKAGE=SE
NODE=M126G;LINKAGE=AE
NODE=M126G;LINKAGE=ES $\Gamma(\omega\pi\pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_3 / \Gamma \times \Gamma_5 / \Gamma$ NODE=M126G4
NODE=M126G4

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.0 ± 0.5		AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow \omega \pi^+ \pi^- \gamma$
4.1 ± 0.9 ± 1.3	1.2M	^{1,2} ACHASOV	03D RVUE	0.44–2.00 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
5.40 ± 0.95		³ AKHMETSHIN	00D CMD2	1.2–1.38 $e^+ e^- \rightarrow \omega \pi^+ \pi^-$
3.18 ± 0.80		^{4,5} CLEGG	94 RVUE	
6.07 ± 0.61	750	^{6,7} ANTONELLI	92 DM2	1.34–2.4 $e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ Calculated by us from the cross section at the peak.

² From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega \pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

³ Using the data of AKHMETSHIN 00D and ANTONELLI 92. The $\rho\pi$ dominance for the energy dependence of the $\omega(1420)$ and $\omega(1650)$ width assumed.

⁴ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

⁵ From the partial and leptonic width given by the authors.

⁶ From the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

⁷ From the product of the leptonic width and partial branching ratio given by the authors.

NODE=M126G4;LINKAGE=AW
NODE=M126G4;LINKAGE=VH

NODE=M126G4;LINKAGE=KL

NODE=M126G4;LINKAGE=AD

NODE=M126G4;LINKAGE=SE
NODE=M126G4;LINKAGE=AE
NODE=M126G4;LINKAGE=ES $\Gamma(\omega\eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_5 / \Gamma$ NODE=M126G5
NODE=M126G5

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.4 ± 0.9	267	¹ ACHASOV	20B SND	$e^+ e^- \rightarrow \omega\eta \rightarrow \eta\pi^0\gamma$
5.62 ± 0.45 ± 0.42		ACHASOV	19 SND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \eta$
4.5 ± 0.3 ± 0.3	824	² AKHMETSHIN	17A CMD3	1.4–2.0 $e^+ e^- \rightarrow \omega\eta$
4.4 ± 0.5	898	³ ACHASOV	16B SND	1.34–2.00 $e^+ e^- \rightarrow \omega\eta$
5.7 ± 0.6	13	AUBERT	06D BABR	10.6 $e^+ e^- \rightarrow \omega\eta\gamma$
< 60 at 90% CL		⁴ AKHMETSHIN	03B CMD2	$e^+ e^- \rightarrow \eta\pi^0\gamma$

¹ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$. The mass of $\omega(1420)$ is fixed to the PDG 18 value of 1420 MeV. Fixing also the width of $\omega(1420)$ to the PDG 18 value of 220 MeV results in $(5.4 \pm 0.6) \times 10^{-7}$ measurement.

² From a fit of the interfering $\omega(1420)$ and $\omega(1650)$ with a relative phase of π and other parameters floating. From an alternative fit $\Gamma(\omega(1650) \rightarrow \omega\eta) / \Gamma_{\text{total}} \times \Gamma(\omega(1650) \rightarrow e^+ e^-) = 51 \pm 3$ eV.

³ From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁴ $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively.

NODE=M126G5;LINKAGE=C

NODE=M126G5;LINKAGE=B

NODE=M126G5;LINKAGE=A
NODE=M126G5;LINKAGE=KH

$\omega(1650)$ BRANCHING RATIOS **$\Gamma(\rho\pi)/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 0.65 1.2M ¹ACHASOV 03D RVUE $0.44-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

0.380 ± 0.014 ²HENNER 02 RVUE $1.2-2.0 e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$

¹From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega\pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

²Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126225

NODE=M126R3
NODE=M126R3

NODE=M126R;LINKAGE=VH

NODE=M126R;LINKAGE=AC

 $\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT

seen ACHASOV 20A SND $1.15-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M126R02
NODE=M126R02 **$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 0.35 1.2M ¹ACHASOV 03D RVUE $0.44-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

0.620 ± 0.014 ²HENNER 02 RVUE $1.2-2.0 e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$

¹From the combined fit of ANTONELLI 92, ACHASOV 01E, ACHASOV 02E, and ACHASOV 03D data on the $\pi^+ \pi^- \pi^0$ and ANTONELLI 92 on the $\omega\pi^+ \pi^-$ final states. Supersedes ACHASOV 99E and ACHASOV 02E.

²Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R2
NODE=M126R2

NODE=M126R2;LINKAGE=VH

NODE=M126R2;LINKAGE=AC

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ **Γ_5/Γ**

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

~ 18 1.2M ^{1,2}ACHASOV 03D RVUE $0.44-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

32 ± 1 ²HENNER 02 RVUE $1.2-2.0 e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$

¹Calculated by us from the cross section at the peak.

²Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R4
NODE=M126R4NODE=M126R;LINKAGE=AW
NODE=M126R4;LINKAGE=AC **$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$** **$\Gamma_6/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ¹ACHASOV 10D SND $1.075-2.0 e^+ e^- \rightarrow \pi^0\gamma$

¹From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. The width of the highest mass effective resonance is fixed at 315 MeV.

NODE=M126R00
NODE=M126R00

NODE=M126R00;LINKAGE=A

 $\omega(1650)$ REFERENCES

NODE=M126

LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)
ACHASOV	20A	EPJ C80 993	M.N. Achasov <i>et al.</i>	(SND Collab.)
ACHASOV	20B	EPJ C80 1008	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND Collab.)
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)
AKHMETSHIN	17A	PL B773 150	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)
ACHASOV	16B	PR D94 092002	M.N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	15A	JETP 121 27	V.M. Aulchenko <i>et al.</i>	(SND Collab.)
Translated from ZETF 148 34.				
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ACHASOV	03D	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	02E	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
HENNER	02	EPJ C26 3	V.K. Henner <i>et al.</i>	
ACHASOV	01E	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>	
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	99E	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
ACHASOV	98H	PR D57 4334	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C52 227	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	ZPHY C39 13	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)
Translated from ZETFP 46 132.				
ATKINSON	83B	PL 127B 132	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
CORDIER	81	PL 106B 155	A. Cordier <i>et al.</i>	(ORSAY)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
ESPOSITO	80	LNC 28 195	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)
COSME	79	NP B152 215	G. Cosme <i>et al.</i>	(IPN)

NODE=M126

REFID=62426
REFID=60923
REFID=60924
REFID=59909
REFID=59887
REFID=59304
REFID=58239
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REFID=41369
REFID=40581
REFID=40280

REFID=21502
REFID=21586
REFID=20553
REFID=21584
REFID=21475

$\omega_3(1670)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M045

 $\omega_3(1670)$ MASS

NODE=M045M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1667 ± 4 OUR AVERAGE				
1665.3 ± 5.2 ± 4.5	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1685 ± 20	60	BAUBILLIER	79 HBC	8.2 $K^- p$ backward
1673 ± 12	430	^{1,2} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
1650 ± 12		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
1669 ± 11	600	² WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
1678 ± 14	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
1660 ± 13	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
1679 ± 17	200	MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
1670 ± 20		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1700	110	¹ CERRADA	77B HBC	$4.2 K^- p \rightarrow \Lambda 3\pi$
1695 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi X$
1636 ± 20		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
¹ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
² From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045M

OCCUR=2

NODE=M045M;LINKAGE=E
NODE=M045M;LINKAGE=P $\omega_3(1670)$ WIDTH

NODE=M045W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
168 ± 10 OUR AVERAGE				
149 ± 19 ± 7	23400	AMELIN	96 VES	$36 \pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
160 ± 80	60	³ BAUBILLIER	79 HBC	8.2 $K^- p$ backward
173 ± 16	430	^{4,5} BALTAY	78E HBC	$15 \pi^+ p \rightarrow \Delta 3\pi$
253 ± 39		CORDEN	78B OMEG	$8-12 \pi^- p \rightarrow N 3\pi$
173 ± 28	600	^{3,5} WAGNER	75 HBC	$7 \pi^+ p \rightarrow \Delta^{++} 3\pi$
167 ± 40	500	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 3\pi^0$
122 ± 39	200	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p \omega \pi^0 \pi^0$
155 ± 40	200	³ MATTHEWS	71D DBC	$7.0 \pi^+ n \rightarrow p 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
90 ± 20		BARNES	69B HBC	$4.6 K^- p \rightarrow \omega 2\pi$
100 ± 40		KENYON	69 DBC	$8 \pi^+ n \rightarrow p 3\pi^0$
112 ± 60		ARMENISE	68B DBC	$5.1 \pi^+ n \rightarrow p 3\pi^0$
³ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.				
⁴ Phase rotation seen for $J^P = 3^- \rho\pi$ wave.				
⁵ From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.				

NODE=M045W

OCCUR=2

NODE=M045W;LINKAGE=S
NODE=M045W;LINKAGE=E
NODE=M045W;LINKAGE=P $\omega_3(1670)$ DECAY MODES

NODE=M045215;NODE=M045

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \rho\pi$	seen
$\Gamma_2 \quad \omega\pi\pi$	seen
$\Gamma_3 \quad b_1(1235)\pi$	possibly seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ← $\omega_3(1670)$ BRANCHING RATIOS

NODE=M045220

$\Gamma(\omega\pi\pi)/\Gamma(\rho\pi)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.71 ± 0.27	100	DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	
$\Gamma(b_1(1235)\pi)/\Gamma(\rho\pi)$					Γ_3/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	
possibly seen		DIAZ	74 DBC	$6 \pi^+ n \rightarrow p 5\pi^0$	

NODE=M045R3
NODE=M045R3NODE=M045R4
NODE=M045R4

$\Gamma(b_1(1235)\pi)/\Gamma(\omega\pi\pi)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.75	68	BAUBILLIER	79	HBC	8.2 $K^- p$ backward

NODE=M045R5
NODE=M045R5

 $\omega_3(1670)$ REFERENCES

AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BAUBILLIER	79	PL 89B 131	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BALTAY	78E	PRL 40 87	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU) JP
CORDEN	78B	NP B138 235	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
CERRADA	77B	NP B126 241	M. Cerrada <i>et al.</i>	(AMST, CERN, NIJM+) JP
WAGNER	75	PL 58B 201	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP
DIAZ	74	PRL 32 260	J. Diaz <i>et al.</i>	(CASE, CMU)
MATTHEWS	71D	PR D3 2561	J.A.J. Matthews <i>et al.</i>	(TNT0, WISC)
BARNES	69B	PRL 23 142	V.E. Barnes <i>et al.</i>	(BNL)
KENYON	69	PRL 23 146	I.R. Kenyon <i>et al.</i>	(BNL, UCND, ORNL)
ARMENISE	68B	PL 26B 336	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)

NODE=M045

REFID=44649
REFID=21522
REFID=21520
REFID=21269
REFID=20537
REFID=20843
REFID=21248
REFID=21515
REFID=21512
REFID=20800
REFID=20783

NODE=M034

 $\pi_2(1670)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

 $\pi_2(1670)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1670.6^{+2.9}_{-1.2} OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

1642 ⁺¹² ₋₁	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1749 ± 10 ± 100	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1676 ± 3 ± 8		² CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
1685 ± 10 ± 30		BARBERIS	01		450 $p p \rightarrow p_f 3\pi^0 p_s$
1687 ± 9 ± 15		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
1669 ± 4		BARBERIS	98B		450 $p p \rightarrow p_f \rho \pi p_s$
1670 ± 4		BARBERIS	98B		450 $p p \rightarrow p_f f_2(1270) \pi p_s$
1690 ± 14		³ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1710 ± 20	700	ANTIPOV	87	SIGM	50 $\pi^- \text{Cu} \rightarrow \mu^+ \mu^- \pi^- \text{Cu}$
1676 ± 6		³ EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
1657 ± 14		^{3,4} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
1662 ± 10	2000	³ BALTAY	77	HBC	15 $\pi^+ p \rightarrow p 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1658 ± 3 ⁺²⁴ ₋₈	420k	⁵ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1730 ± 20		⁶ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1742 ± 31 ± 49		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1624 ± 21		² BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1622 ± 35		⁷ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1693 ± 28		⁸ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
1710 ± 20		⁹ DAUM	81B	SPEC	63,94 $\pi^- p$
1660 ± 10		³ ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

¹ Statistical error negligible.

² From $f_2(1270)\pi$ decay.

³ From a fit to $J^P = 2^- S$ -wave $f_2(1270)\pi$ partial wave.

⁴ Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.

⁵ Superseded by AGHASYAN 2018B.

⁶ J^{PC} ambiguous.

⁷ From $\rho\pi$ decay.

⁸ From $\sigma\pi$ decay.

NODE=M034M

NODE=M034M

OCCUR=2

OCCUR=2

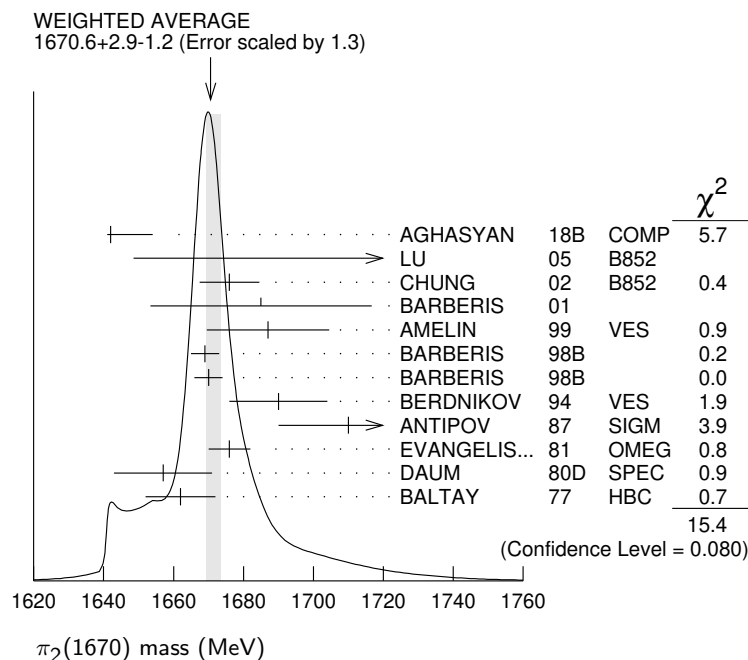
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NODE=M034M;LINKAGE=A
NODE=M034M;LINKAGE=F2
NODE=M034M;LINKAGE=P
NODE=M034M;LINKAGE=D

NODE=M034M;LINKAGE=B
NODE=M034M;LINKAGE=AX
NODE=M034M;LINKAGE=R2
NODE=M034M;LINKAGE=S2

⁹ From a two-resonance fit to four 2^-0^+ waves. This should not be averaged with all the single resonance fits.

NODE=M034M;LINKAGE=L



$\pi_2(1670)$ WIDTH

NODE=M034W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M034W

258⁺₉ OUR AVERAGE

Error includes scale factor of 1.2.

311 ⁺ ₂₃	46M	¹⁰ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
408 $\pm$ 60 $\pm$ 250	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
254 $\pm$ 3 $\pm$ 31		¹¹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
265 $\pm$ 30 $\pm$ 40		BARBERIS	01		450 $pp \rightarrow p_f 3\pi^0 p_s$
168 $\pm$ 43 $\pm$ 53		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268 $\pm$ 15		BARBERIS	98B		450 $pp \rightarrow p_f p \pi p_s$
256 $\pm$ 15		BARBERIS	98B		450 $pp \rightarrow p_f f_2(1270) \pi p_s$
190 $\pm$ 50		¹² BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170 $\pm$ 80	700	ANTIPOV	87	SIGM	50 $\pi^- Cu \rightarrow \mu^+ \mu^- \pi^- Cu$
260 $\pm$ 20		¹² EVANGELIS...	81	OMEG	12 $\pi^- p \rightarrow 3\pi p$
219 $\pm$ 20		^{12,13} DAUM	80D	SPEC	63-94 $\pi p \rightarrow 3\pi X$
285 $\pm$ 60	2000	¹² BALTAY	77	HBC	15 $\pi^+ p \rightarrow p 3\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

271 $\pm$ 9 ⁺ ₂₄	420k	¹⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
310 $\pm$ 20		¹⁵ AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
236 $\pm$ 49 $\pm$ 36		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0 \pi^0$
304 $\pm$ 22		¹¹ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
404 $\pm$ 108		¹⁶ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
330 $\pm$ 90		¹⁷ BELLINI	85	SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$
312 $\pm$ 50		¹⁸ DAUM	81B	SPEC	63,94 $\pi^- p$
270 $\pm$ 60		¹² ASCOLI	73	HBC	5-25 $\pi^- p \rightarrow p \pi_2$

OCCUR=2

OCCUR=2

OCCUR=3

- ¹⁰ Statistical error negligible.
¹¹ From $f_2(1270)\pi$ decay.
¹² From a fit to $J^P = 2^- f_2(1270)\pi$ partial wave.
¹³ Clear phase rotation seen in $2^- S$, $2^- P$, $2^- D$ waves. We quote central value and spread of single-resonance fits to three channels.
¹⁴ Superseded by AGHASYAN 2018B.
¹⁵ J^{PC} ambiguous.
¹⁶ From $\rho\pi$ decay.
¹⁷ From $\sigma\pi$ decay.
¹⁸ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

NODE=M034W;LINKAGE=A
 NODE=M034W;LINKAGE=F2
 NODE=M034W;LINKAGE=P
 NODE=M034W;LINKAGE=D

 NODE=M034W;LINKAGE=B
 NODE=M034W;LINKAGE=AX
 NODE=M034W;LINKAGE=R2
 NODE=M034W;LINKAGE=S2
 NODE=M034W;LINKAGE=L

$\pi_2(1670)$ DECAY MODES

NODE=M034215;NODE=M034

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	3π	$(95.8 \pm 1.4) \%$	
Γ_2	$\pi^+ \pi^- \pi^0$		
Γ_3	$\pi^0 \pi^0 \pi^0$		
Γ_4	$f_2(1270)\pi$	$(56.3 \pm 3.2) \%$	
Γ_5	$\rho\pi$	$(31 \pm 4) \%$	
Γ_6	$\sigma\pi$	$(10 \pm 4) \%$	
Γ_7	$\pi(\pi\pi)_S\text{-wave}$	$(8.7 \pm 3.4) \%$	
Γ_8	$\pi^\pm \pi^+ \pi^-$	$(53 \pm 4) \%$	
Γ_9	$K \bar{K}^*(892) + \text{c.c.}$	$(4.2 \pm 1.4) \%$	
Γ_{10}	$\omega\rho$	$(2.7 \pm 1.1) \%$	
Γ_{11}	$\pi^\pm \gamma$	$(7.0 \pm 1.2) \times 10^{-4}$	
Γ_{12}	$\gamma\gamma$	$< 2.8 \times 10^{-7}$	90%
Γ_{13}	$\eta\pi$	$< 5 \%$	
Γ_{14}	$\pi^\pm 2\pi^+ 2\pi^-$	$< 5 \%$	
Γ_{15}	$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%
Γ_{16}	$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%
Γ_{17}	$f_1(1285)\pi$	possibly seen	
Γ_{18}	$a_2(1320)\pi$	not seen	

DESIG=20
 DESIG=22
 DESIG=23
 DESIG=8
 DESIG=2
 DESIG=13
 DESIG=11
 DESIG=10
 DESIG=5
 DESIG=14
 DESIG=27
 DESIG=12
 DESIG=3
 DESIG=4
 DESIG=15
 DESIG=16
 DESIG=25
 DESIG=26

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 6 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 1.9$ for 3 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	-53		
x_7	-29	-59	
x_9	-8	-21	-9
	x_4	x_5	x_7

$\pi_2(1670)$ PARTIAL WIDTHS

NODE=M034217

$\Gamma(\pi^\pm \gamma)$					Γ_{11}
VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT	
$181 \pm 11 \pm 27$	19 ADOLPH	14	COMP	—	190 $\pi^- \text{Pb} \rightarrow \pi^+ \pi^- \pi^- \text{Pb}'$

NODE=M034W2
 NODE=M034W2

- ¹⁹ Primakoff reaction. Assumes incoherent $f_2(1270)\pi$ contribution to 3π final state and uses $B(\pi_2(1670) \rightarrow f_2\pi) = 56\%$.

NODE=M034W2;LINKAGE=AD

$\Gamma(\gamma\gamma)$ Γ_{12}

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.072	90	20 ACCIARRI	97T	L3	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.19	90	20 ALBRECHT	97B	ARG	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.41 $\pm 0.23 \pm 0.28$		ANTREASYAN	90	CBAL	0 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0\pi^0$
0.8 $\pm 0.3 \pm 0.12$		21 BEHREND	90C	CELL	0 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$
1.3 $\pm 0.3 \pm 0.2$		22 BEHREND	90C	CELL	0 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\pi^0$

20 Decaying into $f_2(1270)\pi$ and $\rho\pi$.21 Constructive interference between $f_2(1270)\pi, \rho\pi$ and background.

22 Incoherent Ansatz.

NODE=M034W1
NODE=M034W1

OCCUR=2

NODE=M034W1;LINKAGE=QQ
NODE=M034W1;LINKAGE=C
NODE=M034W1;LINKAGE=G $\pi_2(1670) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M034230

 $\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{12}/\Gamma$

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.1	95	23 SCHEGELSKY	06	RVUE $\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
23 From analysis of L3 data at 183–209 GeV.				

NODE=M034G01
NODE=M034G01

NODE=M034G01;LINKAGE=SC

 $\pi_2(1670) \text{ BRANCHING RATIOS}$

NODE=M034220

 $\Gamma(3\pi)/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_4 + \Gamma_5 + \Gamma_7)/\Gamma$

VALUE	DOCUMENT ID
0.958 ± 0.014 OUR FIT	

NODE=M034R20
NODE=M034R20 $\Gamma(\pi^0\pi^0\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_3/Γ_2

VALUE	DOCUMENT ID	COMMENT
0.29 $\pm 0.03 \pm 0.05$	BARBERIS 01	450 $p p \rightarrow p_f 3\pi^0 p_s$

NODE=M034R21
NODE=M034R21 $\Gamma(\rho\pi)/0.565\Gamma(f_2(1270)\pi)$ $\Gamma_5/0.565\Gamma_4$ (With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.09 OUR AVERAGE	Error includes scale factor of 1.9.		
0.76 $\pm 0.07 \pm 0.10$	CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$
1.01 ± 0.05	BARBERIS	98B	450 $p p \rightarrow p_f \pi^+\pi^-\pi^0 p_s$

NODE=M034R16
NODE=M034R16
NODE=M034R16 $\Gamma(\sigma\pi)/\Gamma(f_2(1270)\pi)$ Γ_6/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 $\pm 0.02 \pm 0.07$	CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.24 ± 0.10	24,25 BAKER	99 SPEC	1.94 $\bar{p} p \rightarrow 4\pi^0$

NODE=M034R15
NODE=M034R15 $\frac{1}{2}\Gamma(\rho\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $\frac{1}{2}\Gamma_5/\Gamma_8 = \frac{1}{2}\Gamma_5/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.29 ± 0.04 OUR FIT				
0.29 ± 0.05	26 DAUM	81B	SPEC	63,94 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.3	BARTSCH	68	HBC	+ 8 $\pi^+ p \rightarrow 3\pi p$

NODE=M034R2
NODE=M034R2 $0.565\Gamma(f_2(1270)\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$ $0.565\Gamma_4/\Gamma_8 = 0.565\Gamma_4/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$ (With $f_2(1270) \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.604 ± 0.035 OUR FIT				
0.60 ± 0.05 OUR AVERAGE	Error includes scale factor of 1.3.			
0.61 ± 0.04	26 DAUM	81B	SPEC	63,94 $\pi^- p$
0.76 $+0.24$ -0.34	ARMENISE	69	DBC	+ 5.1 $\pi^+ d \rightarrow d 3\pi$
0.35 ± 0.20	BALTAY	68	HBC	+ 7–8.5 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.59	BARTSCH	68	HBC	+ 8 $\pi^+ p \rightarrow 3\pi p$

NODE=M034R3
NODE=M034R3
NODE=M034R3

$0.624\Gamma(\pi(\pi\pi)_{S\text{-wave}})/\Gamma(\pi^\pm\pi^+\pi^-)$

$0.624\Gamma_7/\Gamma_8 = 0.624\Gamma_7/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

(With $(\pi\pi)_{S\text{-wave}} \rightarrow \pi^+\pi^-$.)

VALUE	DOCUMENT ID	TECN	COMMENT
0.10 ± 0.04 OUR FIT			
0.10 ± 0.05	26 DAUM	81B SPEC	63,94 $\pi^- p$

NODE=M034R11

NODE=M034R11
NODE=M034R11 **$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(f_2(1270)\pi)$** **$\Gamma_9/\Gamma_4$**

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.075 ± 0.025 OUR FIT				
0.075 ± 0.025	27 ARMSTRONG	82B OMEG	—	16 $\pi^- p \rightarrow K^+ K^- \pi^- p$

NODE=M034R13

NODE=M034R13

 $\Gamma(\omega\rho)/\Gamma_{\text{total}}$ **Γ_{10}/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
$0.027 \pm 0.004 \pm 0.010$	28 AMELIN	99 VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R17

NODE=M034R17

 $\Gamma(\eta\pi)/\Gamma(\pi^\pm\pi^+\pi^-)$

$\Gamma_{13}/\Gamma_8 = \Gamma_{13}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

(All η decays.)

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.09	BALTAY	68 HBC	+	7-8.5 $\pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.10	CRENNELL	70 HBC	—	6 $\pi^- p \rightarrow f_2 \pi^- N$

NODE=M034R5

NODE=M034R5

NODE=M034R5

 $\Gamma(\pi^\pm 2\pi^+ 2\pi^-)/\Gamma(\pi^\pm\pi^+\pi^-)$

$\Gamma_{14}/\Gamma_8 = \Gamma_{14}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	CRENNELL	70 HBC	—	6 $\pi^- p \rightarrow f_2 \pi^- N$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.1	BALTAY	68 HBC	+	7,8.5 $\pi^+ p$

NODE=M034R6

NODE=M034R6

 $\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$ **Γ_{15}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN	99 VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R18

NODE=M034R18

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ **Γ_{16}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN	99 VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R19

NODE=M034R19

 $\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$ **Γ_{17}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	69k	KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M034R23

NODE=M034R23

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ **Γ_{18}/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	69k	KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M034R24

NODE=M034R24

D-wave/S-wave RATIO FOR $\pi_2(1670) \rightarrow f_2(1270)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.18 ± 0.06	24 BAKER	99 SPEC	1.94 $\bar{p} p \rightarrow 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.22 ± 0.10	26 DAUM	81B SPEC	63,94 $\pi^- p$

NODE=M034R14

NODE=M034R14

F-wave/P-wave RATIO FOR $\pi_2(1670) \rightarrow \rho\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.72 \pm 0.07 \pm 0.14$	CHUNG	02 B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M034R22

NODE=M034R22

24 Using preliminary CBAR data.

25 With the $\sigma\pi$ in $L=2$ and the $f_2(1270)\pi$ in $L=0$.26 From a two-resonance fit to four 2^-0^+ waves.27 From a partial-wave analysis of $K^+ K^- \pi^-$ system.28 Normalized to the $B(\pi_2(1670) \rightarrow f_2\pi)$.

NODE=M034R;LINKAGE=BK

NODE=M034R15;LINKAGE=A

NODE=M034R;LINKAGE=L

NODE=M034R13;LINKAGE=M

NODE=M034R;LINKAGE=DM

$\pi_2(1670)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADOLPH	14	EPJ A50 79	C. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
BARBERIS	01	PL B507 14	D. Barberis <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
Translated from YAF 62 487.				
BAKER	99	PL B449 114	C.A. Baker <i>et al.</i>	
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)
ALBRECHT	97B	ZPHY C74 469	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
ANTREASYAN	90	ZPHY C48 561	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BEHREND	90C	ZPHY C46 583	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
ANTIPOV	87	EPL 4 403	Y.M. Antipov <i>et al.</i>	(SERP, JINR, INRM+)
BELLINI	85	SJNP 41 781	D. Bellini <i>et al.</i>	
Translated from YAF 41 1223.				
ARMSTRONG	82B	NP B202 1	T.A. Armstrong, B. Baccari	(AACH3, BARI, BONN+)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
Also		NP B186 594	C. Evangelista	
DAUM	80D	PL B9B 285	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+) JP
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalekar	(COLU) JP
ASCOLI	73	PR D7 669	G. Ascoli	(ILL, TATO, GENO, HAMB, MILA+) JP
CRENNELL	70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE	69	LNC 2 501	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
BARTSCH	68	NP B7 345	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN) JP

NODE=M034

REFID=59471
REFID=55911
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REFID=21532

NODE=M067

 $\phi(1680)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 $\phi(1680)$ MASS

NODE=M067205

 e^+e^- PRODUCTION

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1680 ±20 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1656.8 ± 4.9		¹ LICHARD	23 RVUE	$e^+e^- \rightarrow \gamma(nS) \rightarrow \phi\eta\gamma$
1683 ± 7 ± 9		² ZHU	23 BELL	$e^+e^- \rightarrow \gamma(nS) \rightarrow \phi\eta\gamma$
1678 $^{+5}_{-3}$ ± 7		³ ZHU	23A RVUE	$e^+e^- \rightarrow \eta\phi$
1673 ± 5		⁴ ABLIKIM	22L BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$
1680 $^{+12}_{-13}$ ±21 1.8k		⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+K^-\eta$
1662 ±20		⁶ ACHASOV	20C SND	$1.3-2.0 e^+e^- \rightarrow K^+K^-\pi^0$
1641 $^{+24}_{-18}$		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
1667 ± 5 ±11 3k		⁷ IVANOV	19A CMD3	$1.59-2.007 e^+e^- \rightarrow K^+K^-\eta$
1700 ±23 2k		⁸ ACHASOV	18A SND	$1.3-2.0 e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
1674 ±12 ± 6 6.2k		⁹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
1733 ±10 ±10		¹⁰ LEES	12F BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
1689 ± 7 ±10 4.8k		¹¹ SHEN	09 BELL	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
1709 ±20 ±43		¹² AUBERT	08S BABR	$10.6 e^+e^- \rightarrow \text{hadrons}$
1623 ±20 948		¹³ AKHMETSHIN	03 CMD2	$1.05-1.38 e^+e^- \rightarrow K_L^0 K_S^0$
~ 1500		¹⁴ ACHASOV	98H RVUE	$e^+e^- \rightarrow \pi^+\pi^-\pi^0, \omega\pi^+\pi^-, K^+K^-$
~ 1900		¹⁵ ACHASOV	98H RVUE	$e^+e^- \rightarrow K_S^0 K^\pm\pi^\mp$
1700 ±20		¹⁶ CLEGG	94 RVUE	$e^+e^- \rightarrow K^+K^-, K_S^0 K\pi$
1657 ±27 367		BISELLO	91C DM2	$e^+e^- \rightarrow K_S^0 K^\pm\pi^\mp$
1655 ±17		¹⁷ BISELLO	88B DM2	$e^+e^- \rightarrow K^+K^-$
1680 ±10		¹⁸ BUON	82 DM1	$e^+e^- \rightarrow \text{hadrons}$
1677 ±12		¹⁹ MANE	82 DM1	$e^+e^- \rightarrow K_S^0 K\pi$

NODE=M067M1

NODE=M067M1

→ UNCHECKED ←

OCCUR=4

- ¹ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7σ statistical evidence.
- ² From a fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution.
- ³ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3.
- ⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.
- ⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+K^-\eta = (12.0 \pm 1.3^{+6.5}_{-6.9}) \times 10^{-6}$.
- ⁶ From a fit using a vector meson dominance model with contribution from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, $\rho(1450)$.
- ⁷ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.
- ⁸ Assuming the $K\bar{K}^*(892) + \text{c.c.}$ dynamics. Systematic uncertainties not estimated.
- ⁹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.
- ¹⁰ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.
- ¹¹ From a fit with two incoherent Breit-Wigners.
- ¹² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.
- ¹³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.
- ¹⁴ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and AN-TONELLI 92.
- ¹⁵ Using the data from BISELLO 91C.
- ¹⁶ Using BISELLO 88B and MANE 82 data.
- ¹⁷ From global fit including ρ , ω , ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.
- ¹⁸ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0K_L^0$, $K_S^0K^\pm\pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.
- ¹⁹ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067M1;LINKAGE=I

NODE=M067M1;LINKAGE=H

NODE=M067M1;LINKAGE=J

NODE=M067M1;LINKAGE=G

NODE=M067M1;LINKAGE=E

NODE=M067M1;LINKAGE=F

NODE=M067M1;LINKAGE=D

NODE=M067M1;LINKAGE=C

NODE=M067M1;LINKAGE=B

NODE=M067M1;LINKAGE=A

NODE=M067M1;LINKAGE=SH

NODE=M067M1;LINKAGE=AU

NODE=M067M;LINKAGE=HK

NODE=M067M1;LINKAGE=L1

NODE=M067M1;LINKAGE=L4

NODE=M067M;LINKAGE=A

NODE=M067M;LINKAGE=E

NODE=M067M;LINKAGE=C

NODE=M067M;LINKAGE=D

NODE=M067M3

NODE=M067M3

 $p\bar{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1700 ± 8	¹ AMSLER	06	CBAR 0.9 $p\bar{p} \rightarrow K^+K^-\pi^0$

¹ Could also be $\rho(1700)$.

NODE=M067M3;LINKAGE=AM

 $\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

150 ± 50 OUR ESTIMATE This is only an educated guess; the error given is larger than the error on the average of the published values.

• • • We do not use the following data for averages, fits, limits, etc. • • •

150.8 ± 7.0	¹ LICHARD	23	RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
149 ± 12 ± 13	² ZHU	23	BELL	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
156 ± 5 ± 9	³ ZHU	23A	RVUE	$e^+e^- \rightarrow \eta\phi$
172 ± 8	⁴ ABLIKIM	22L	BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$
185 $^{+30}_{-26}$ $^{+25}_{-47}$ 1.8k	⁵ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+K^-\eta$
159 ± 32	⁶ ACHASOV	20C	SND	$1.3-2.0 e^+e^- \rightarrow K^+K^-\pi^0$
103 $^{+26}_{-24}$	ACHASOV	19	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
176 ± 23 ± 38 3k	⁷ IVANOV	19A	CMD3	$1.59-2.007 e^+e^- \rightarrow K^+K^-\eta$
300 ± 50 2k	⁸ ACHASOV	18A	SND	$1.3-2.0 e^+e^- \rightarrow K_S^0K_L^0\pi^0$
165 ± 38 ± 70 6.2k	⁹ LEES	14H	BABR	$e^+e^- \rightarrow K_S^0K_L^0\gamma$
300 ± 15 ± 37	¹⁰ LEES	12F	BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
211 ± 14 ± 19 4.8k	¹¹ SHEN	09	BELL	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M067W1

NODE=M067W1

→ UNCHECKED ←

322	± 77	± 160	12	AUBERT	08S	BABR	10.6	$e^+e^- \rightarrow \text{hadrons}$
139	± 60	948	13	AKHMETSHIN	03	CMD2	1.05–1.38	$e^+e^- \rightarrow K_L^0 K_S^0$
300	± 60		14	CLEGG	94	RVUE		$e^+e^- \rightarrow K^+ K^-, K_S^0 K \pi$
146	± 55	367		BISELLO	91C	DM2		$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
207	± 45		15	BISELLO	88B	DM2		$e^+e^- \rightarrow K^+ K^-$
185	± 22		16	BUON	82	DM1		$e^+e^- \rightarrow \text{hadrons}$
102	± 36		17	MANE	82	DM1		$e^+e^- \rightarrow K_S^0 K \pi$

¹ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7 σ statistical evidence.

² From a fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution.

³ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3.

⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (12.0 \pm 1.3^{+6.5}_{-6.9}) \times 10^{-6}$.

⁶ From a fit using a vector meson dominance model with contribution from $\rho(770)$, $\omega(782)$, $\phi(1020)$, $\omega(1420)$, $\rho(1450)$.

⁷ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

⁸ Assuming the $K\bar{K}^*(892) + \text{c.c.}$ dynamics. Systematic uncertainties not estimated.

⁹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

¹⁰ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

¹¹ From a fit with two incoherent Breit-Wigners.

¹² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

¹³ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.

¹⁴ Using BISELLO 88B and MANE 82 data.

¹⁵ From global fit including ρ , ω , ϕ and $\rho(1700)$

¹⁶ From global fit of ρ , ω , ϕ and their radial excitations to channels $\omega\pi^+\pi^-$, K^+K^- , $K_S^0 K_L^0$, $K_S^0 K^\pm \pi^\mp$. Assume mass 1570 MeV and width 510 MeV for ρ radial excitations, mass 1570 and width 500 MeV for ω radial excitation.

¹⁷ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=I

NODE=M067W1;LINKAGE=H

NODE=M067W1;LINKAGE=J

NODE=M067W1;LINKAGE=G

NODE=M067W1;LINKAGE=E

NODE=M067W1;LINKAGE=F

NODE=M067W1;LINKAGE=D

NODE=M067W1;LINKAGE=C

NODE=M067W1;LINKAGE=B

NODE=M067W1;LINKAGE=A

NODE=M067W1;LINKAGE=SH

NODE=M067W1;LINKAGE=AU

NODE=M067W;LINKAGE=HK

NODE=M067W;LINKAGE=A

NODE=M067W;LINKAGE=E

NODE=M067W;LINKAGE=C

NODE=M067W;LINKAGE=D

NODE=M067W3

NODE=M067W3

$p\bar{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

143 $\pm$ 24	¹ AMSLER	06	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$

¹ Could also be $\rho(1700)$.

NODE=M067W3;LINKAGE=AM

$\phi(1680)$ DECAY MODES

NODE=M067215;NODE=M067

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}^*(892) + \text{c.c.}$	seen
Γ_2 $K_S^0 K \pi$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $K_L^0 K_S^0$	
Γ_5 e^+e^-	seen
Γ_6 $\omega\pi\pi$	not seen
Γ_7 $\phi\pi\pi$	
Γ_8 $K^+ K^- \pi^+ \pi^-$	seen
Γ_9 $\eta\phi$	seen
Γ_{10} $\eta\gamma$	seen
Γ_{11} $K^+ K^- \pi^0$	
Γ_{12} $f_2'(1525)\gamma$	not seen

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=11

DESIG=12;OUR EVAL;→ UNCHECKED ←

DESIG=10

DESIG=13

DESIG=2

DESIG=15

$\phi(1680) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

This combination of a partial width with the partial width into $e^+ e^-$ and with the total width is obtained from the integrated cross section into channel (i) in $e^+ e^-$ annihilation. We list only data that have not been used to determine the partial width $\Gamma(i)$ or the branching ratio $\Gamma(i)/\text{total}$.

NODE=M067220

NODE=M067220

 $\Gamma(K_L^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_4 \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

14.3 ± 2.4 ± 6.2	6.2k	¹ LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \gamma$

¹ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

NODE=M067A00
NODE=M067A00

NODE=M067A00;LINKAGE=A

 $\Gamma(\phi \pi \pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_5 / \Gamma$

VALUE (10 ⁻² keV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2 ± 0.2 ± 0.3	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$

NODE=M067G02
NODE=M067G02 $\Gamma(\eta \phi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

122 ± 6 ± 13		¹ ZHU	23 BELL	$e^+ e^- \rightarrow \Upsilon(nS) \rightarrow \phi \eta \gamma$

65 ⁺⁵ ₋₄ ± 13 to		² ZHU	23A RVUE	$e^+ e^- \rightarrow \eta \phi$

215 ⁺⁸ ₋₅ ± 11				

94 ± 13 ± 15	3k	³ IVANOV	19A CMD3	1.59–2.007 $e^+ e^- \rightarrow K^+ K^- \eta$

¹ From a solution of the fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution. Other solutions with equal fit quality give (219 ± 15 ± 18) eV, (163 ± 11 ± 13) eV and (203 ± 12 ± 18) eV.

² From the analysis of the combined measurements of $\sigma(e^+ e^- \rightarrow \eta \phi)$ from BaBar, Belle, BESIII, CMD3. Four solutions are found, with equal fit quality: (79 ± 4 ± 16) eV, (127 ± 5 ± 12) eV, (65⁺⁵₋₄ ± 13) eV, (215⁺⁸₋₅ ± 11) eV.

³ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

NODE=M067R00
NODE=M067R00

NODE=M067R00;LINKAGE=B

NODE=M067R00;LINKAGE=C

NODE=M067R00;LINKAGE=A

 $\phi(1680) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

This combination of a branching ratio into channel (i) and branching ratio into $e^+ e^-$ is directly measured and obtained from the cross section at the peak. We list only data that have not been used to determine the branching ratio into (i) or $e^+ e^-$.

NODE=M067223

NODE=M067223

 $\Gamma(K_L^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_5 / \Gamma$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.131 ± 0.059	948	¹ AKHMETSHIN 03	CMD2	1.05–1.38 $e^+ e^- \rightarrow K_L^0 K_S^0$

¹ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known. Recalculated by us.

NODE=M067G5
NODE=M067G5

NODE=M067G;LINKAGE=GK

 $\Gamma(K \bar{K}^*(892) + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 / \Gamma \times \Gamma_5 / \Gamma$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.15 ± 0.16 ± 0.01		¹ AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K \bar{K}^*(892) \gamma + \text{c.c.}$

3.29 ± 1.57	367	² BISELLO	91C DM2	1.35–2.40 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

¹ From the simultaneous fit to the $K \bar{K}^*(892) + \text{c.c.}$ and $\phi \eta$ data from AUBERT 08S using the results of AUBERT 07AK.

² Recalculated by us with the published value of $B(K \bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+ e^-)$.

NODE=M067G6
NODE=M067G6

NODE=M067G6;LINKAGE=AU

NODE=M067G;LINKAGE=GL

 $\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 / \Gamma \times \Gamma_5 / \Gamma$

VALUE (units 10 ⁻⁷)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.86 ± 0.14 ± 0.21	4.8k	¹ SHEN	09 BELL	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ Multiplied by 3/2 to take into account the $\phi \pi^0 \pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.

NODE=M067G01
NODE=M067G01

NODE=M067G01;LINKAGE=SH

$$\Gamma(\eta\phi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma \times \Gamma_5/\Gamma$$

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.64^{+1.74}_{-1.80}$		ACHASOV	19	SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
$5.3 \pm 0.6 \pm 0.9$	3k	¹ IVANOV	19A	CMD3	$1.59\text{--}2.007 e^+e^- \rightarrow K^+K^-\eta$
$4.3 \pm 1.0 \pm 0.9$		² AUBERT	08S	BABR	$10.6 e^+e^- \rightarrow \phi\eta\gamma$

¹ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

² From the simultaneous fit to the $K\bar{K}^*(892) + \text{c.c.}$ and $\phi\eta$ data from AUBERT 08S using the results of AUBERT 07AK.

NODE=M067G7
NODE=M067G7

NODE=M067G7;LINKAGE=A
NODE=M067G7;LINKAGE=AU

$\phi(1680)$ BRANCHING RATIOS

NODE=M067225

$$\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(K_S^0 K \pi)$$

$$\Gamma_1/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
dominant	MANE	82	DM1 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M067R3
NODE=M067R3

$$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892) + \text{c.c.})$$

$$\Gamma_3/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.07 ± 0.01	BUON	82	DM1 e^+e^-

NODE=M067R2
NODE=M067R2

$$\Gamma(\omega\pi\pi)/\Gamma(K\bar{K}^*(892) + \text{c.c.})$$

$$\Gamma_6/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
<0.10	BUON	82	DM1 e^+e^-

NODE=M067R1
NODE=M067R1

$$\Gamma(\eta\phi)/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	35	¹ ACHASOV	14	SND $1.15\text{--}2.00 e^+e^- \rightarrow \eta\gamma$

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R01
NODE=M067R01

NODE=M067R01;LINKAGE=A

$$\Gamma(\eta\phi)/\Gamma(K\bar{K}^*(892) + \text{c.c.})$$

$$\Gamma_9/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

≈ 0.37	¹ AUBERT	08S	BABR $10.6 e^+e^- \rightarrow \text{hadrons}$

¹ From the fit including data from AUBERT 07AK.

NODE=M067R5
NODE=M067R5

NODE=M067R5;LINKAGE=AU

$$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{10}/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	35	¹ ACHASOV	14	SND $1.15\text{--}2.00 e^+e^- \rightarrow \eta\gamma$

¹ From a phenomenological model based on vector meson dominance with $\rho(1450)$ and $\phi(1680)$ masses and widths from the PDG 12.

NODE=M067R02
NODE=M067R02

NODE=M067R02;LINKAGE=A

$$\Gamma(f_2'(1525)\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{12}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ACHASOV	22	SND $1.17\text{--}2.00 e^+e^- \rightarrow \eta\eta\gamma$

¹ The 90% CL upper limit on the Born cross sections $\sigma(e^+e^- \rightarrow \phi(1680) \rightarrow f_2'(1525)\gamma \rightarrow \eta\eta\gamma)$ and $\sigma(e^+e^- \rightarrow \rho(1700) \rightarrow f_0(1500)\gamma \rightarrow \eta\eta\gamma)$ is 10.6 pb.

NODE=M067R03
NODE=M067R03

NODE=M067R03;LINKAGE=A

$\phi(1680)$ REFERENCES

NODE=M067

LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)	REFID=62426
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)	REFID=61911
ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)	REFID=62439
ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61649
ACHASOV	22	EPJ C82 168	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=61655
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
ACHASOV	20C	EPJ C80 1139	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60935
ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=59887
IVANOV	19A	PL B798 134946	V.L. Ivanov <i>et al.</i>	(CMD-3 Collab.)	REFID=60133
ACHASOV	18A	PR D97 032011	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=58883
ACHASOV	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=55912
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
PDG	12	PR D86 010001	J. Beringer <i>et al.</i>	(PDG Collab.)	REFID=54066
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000

AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin	
ACHASOV	98H	Translated from YAF 65 1255.	N.N. Achasov, A.A. Kozhevnikov	
CLEGG	94	PR D57 4334	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ANTONELLI	92	ZPHY C62 455	A. Antonelli <i>et al.</i>	(DM2 Collab.)
BISELLO	91C	ZPHY C56 15	D. Bisello <i>et al.</i>	(DM2 Collab.)
DOLINSKY	91	ZPHY C52 227	S.I. Dolinsky <i>et al.</i>	(NOVO)
BISELLO	88B	PRPL 202 99	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BARKOV	87	ZPHY C39 13	L.M. Barkov <i>et al.</i>	(NOVO)
		JETPL 46 164		
BUON	82	Translated from ZETFP 46 132.	J. Buon <i>et al.</i>	(LALO, MONP)
MANE	82	PL 118B 221	F. Mane <i>et al.</i>	(LALO)
IVANOV	81	PL 112B 178	P.M. Ivanov <i>et al.</i>	(NOVO)
MANE	81	PL 107B 297	F. Mane <i>et al.</i>	(ORSAY)
MANE	81	PL 99B 261		

REFID=52242
REFID=51908
REFID=51136
REFID=49172
REFID=48827

REFID=46323
REFID=44081
REFID=43168
REFID=41867
REFID=41369
REFID=40581
REFID=40280

REFID=21494
REFID=21590
REFID=20553
REFID=21588

NODE=M015

$\rho_3(1690)$

$$I^G(J^{PC}) = 1^+(3^--)$$

$\rho_3(1690)$ MASS

NODE=M015205

VALUE (MeV) _____ DOCUMENT ID _____
1688.8 ± 2.1 OUR AVERAGE Includes data from the 5 datablocks that follow this one.

NODE=M015M

2 π MODE

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
The data in this block is included in the average printed for a previous datablock.

NODE=M015M1
NODE=M015M1

1686 ± 4 OUR AVERAGE

1677 ± 14		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
1679 ± 11	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow \pi^+ \pi^- n$
1678 ± 12	175	¹ ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
1690 ± 7	600	¹ ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow \pi^+ \pi^- p$
1693 ± 8		² GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
1678 ± 12		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1734 ± 10		³ CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow n 2\pi$
1692 ± 12		^{2,4} ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$
1737 ± 23		ARMENISE	70	DBC	0	9 $\pi^+ N$
1650 ± 35	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
1687 ± 21		STUNTEBECK	70	HDBC	0	8 $\pi^- p, 5.4 \pi^+ d$
1683 ± 13		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
1670 ± 30		GOLDBERG	65	HBC	0	6 $\pi^+ d, 8 \pi^- p$

¹ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

² Uses same data as HYAMS 75.

³ From a phase shift solution containing a $f_2'(1525)$ width two times larger than the $K\bar{K}$ result.

⁴ From phase-shift analysis. Error takes account of spread of different phase-shift solutions.

NODE=M015M1;LINKAGE=E
NODE=M015M1;LINKAGE=G
NODE=M015M1;LINKAGE=M
NODE=M015M1;LINKAGE=I

$K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV) _____ EVTS _____ DOCUMENT ID _____ TECN _____ CHG _____ COMMENT _____
The data in this block is included in the average printed for a previous datablock.

NODE=M015M2
NODE=M015M2

1696 ± 4 OUR AVERAGE

1699 ± 5		ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$
1698 ± 12	6k	^{5,6} MARTIN	78D	SPEC		10 $\pi p \rightarrow K_S^0 K^- p$
1692 ± 6		BLUM	75	ASPK	0	18.4 $\pi^- p \rightarrow n K^+ K^-$
1690 ± 16		ADERHOLZ	69	HBC	+	8 $\pi^+ p \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1694 ± 8		⁷ COSTA	80	OMEG		10 $\pi^- p \rightarrow K^+ K^- n$

⁵ From a fit to $J^P = 3^-$ partial wave.

⁶ Systematic error on mass scale subtracted.

⁷ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.

NODE=M015M2;LINKAGE=P
NODE=M015M2;LINKAGE=S
NODE=M015M2;LINKAGE=L

(4 π)[±] MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015M3
 NODE=M015M3

1686 ± 5 OUR AVERAGE Error includes scale factor of 1.1.

1694 ± 6		⁸ EVANGELIS...	81	OMEG	−	12 $\pi^- p \rightarrow p4\pi$
1665 ± 15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p4\pi$
1670 ± 10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687 ± 20		CASON	73	HBC	−	8,18.5 $\pi^- p$
1685 ± 14		⁹ CASON	73	HBC	−	8,18.5 $\pi^- p$
1680 ± 40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N4\pi$
1689 ± 20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N2\rho$
1705 ± 21		CASO	70	HBC	−	11.2 $\pi^- p \rightarrow n\rho2\pi$

OCCUR=2

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

1718 ± 10		¹⁰ EVANGELIS...	81	OMEG	−	12 $\pi^- p \rightarrow p4\pi$
1673 ± 9		¹¹ EVANGELIS...	81	OMEG	−	12 $\pi^- p \rightarrow p4\pi$
1733 ± 9	66	⁹ KLIGER	74	HBC	−	4.5 $\pi^- p \rightarrow p4\pi$
1630 ± 15		HOLMES	72	HBC	+	10–12 $K^+ p$
1720 ± 15		BALTAY	68	HBC	+	7, 8.5 $\pi^+ p$

OCCUR=2

OCCUR=3

⁸ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.⁹ From $\rho^\pm \rho^0$ mode.¹⁰ From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.¹¹ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

NODE=M015M3;LINKAGE=A
 NODE=M015M3;LINKAGE=F
 NODE=M015M3;LINKAGE=B
 NODE=M015M3;LINKAGE=C

 $\omega\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015M5
 NODE=M015M5

1681 ± 7 OUR AVERAGE

1670 ± 25		¹² ALDE	95	GAM2		38 $\pi^- p \rightarrow \omega\pi^0 n$
1690 ± 15		EVANGELIS...	81	OMEG	−	12 $\pi^- p \rightarrow \omega\pi p$
1666 ± 14		GESSAROLI	77	HBC		11 $\pi^- p \rightarrow \omega\pi p$
1686 ± 9		THOMPSON	74	HBC	+	13 $\pi^+ p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1654 ± 24		BARNHAM	70	HBC	+	10 $K^+ p \rightarrow \omega\pi X$

¹² Supersedes ALDE 92C.

NODE=M015M5;LINKAGE=A

 $\eta\pi^+\pi^-$ MODE(For difficulties with MMS experiments, see the $a_2(1320)$ mini-review in the 1973 edition.)

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015M6

NODE=M015M6

NODE=M015M6

1682 ± 12 OUR AVERAGE

1685 ± 10 ± 20		AMELIN	00	VES		37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
1680 ± 15		FUKUI	88	SPEC	0	8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1700 ± 47		¹³ ANDERSON	69	MMS	−	16 $\pi^- p$ backward
1632 ± 15		^{13,14} FOCACCI	66	MMS	−	7–12 $\pi^- p \rightarrow pMM$
1700 ± 15		^{13,14} FOCACCI	66	MMS	−	7–12 $\pi^- p \rightarrow pMM$
1748 ± 15		^{13,14} FOCACCI	66	MMS	−	7–12 $\pi^- p \rightarrow pMM$

OCCUR=2

OCCUR=3

¹³ Seen in 2.5–3 GeV/c $\bar{p}p$. $2\pi^+2\pi^-$, with 0, 1, 2 $\pi^+\pi^-$ pairs in ρ band not seen by OREN 74 (2.3 GeV/c $\bar{p}p$) with more statistics. (Jan. 1976)¹⁴ Not seen by BOWEN 72.

NODE=M015M6;LINKAGE=R

NODE=M015M6;LINKAGE=N

 $\rho_3(1690)$ WIDTH

NODE=M015210

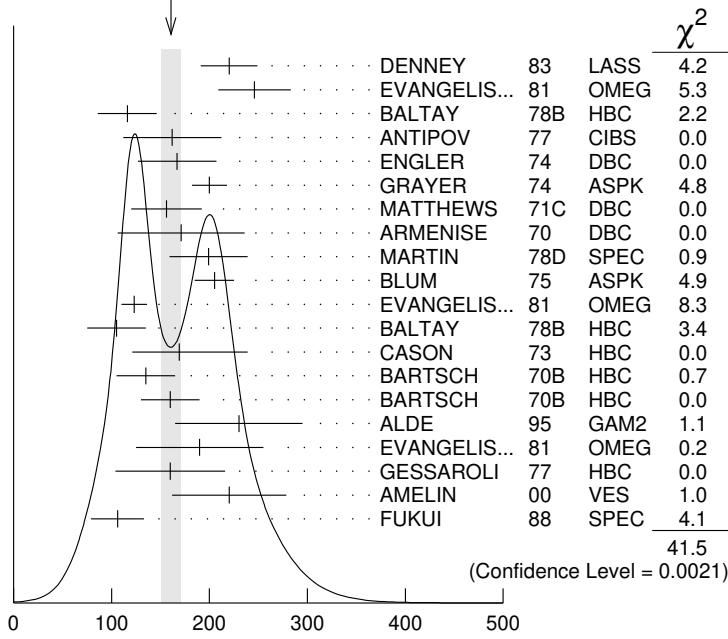
2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

VALUE (MeV)	DOCUMENT ID

161 ± 10 OUR AVERAGE Includes data from the 5 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.

NODE=M015W
 NODE=M015W

WEIGHTED AVERAGE
161±10 (Error scaled by 1.5)



$\rho_3(1690)$ width, 2π , $K\bar{K}$, and $K\bar{K}\pi$ modes (MeV)

2 π MODE

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015W1
NODE=M015W1

186±14 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

220±29		DENNEY	83	LASS		10 $\pi^+ N$
246±37		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow 2\pi p$
116±30	476	BALTAY	78B	HBC	0	15 $\pi^+ p \rightarrow \pi^+ \pi^- n$
162±50	175	15 ANTIPOV	77	CIBS	0	25 $\pi^- p \rightarrow p 3\pi$
167±40	600	ENGLER	74	DBC	0	6 $\pi^+ n \rightarrow \pi^+ \pi^- p$
200±18		16 GRAYER	74	ASPK	0	17 $\pi^- p \rightarrow \pi^+ \pi^- n$
156±36		MATTHEWS	71C	DBC	0	7 $\pi^+ N$
171±65		ARMENISE	70	DBC	0	9 $\pi^+ d$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
322±35		17 CORDEN	79	OMEG		12–15 $\pi^- p \rightarrow n 2\pi$
240±30		16,18 ESTABROOKS	75	RVUE		17 $\pi^- p \rightarrow \pi^+ \pi^- n$
180±30	122	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N 2\pi$
267 ⁺⁷² ₋₄₆		STUNTEBECK	70	HDBC	0	8 $\pi^- p$, 5.4 $\pi^+ d$
188±49		ARMENISE	68	DBC	0	5.1 $\pi^+ d$
180±40		GOLDBERG	65	HBC	0	6 $\pi^+ d$, 8 $\pi^- p$

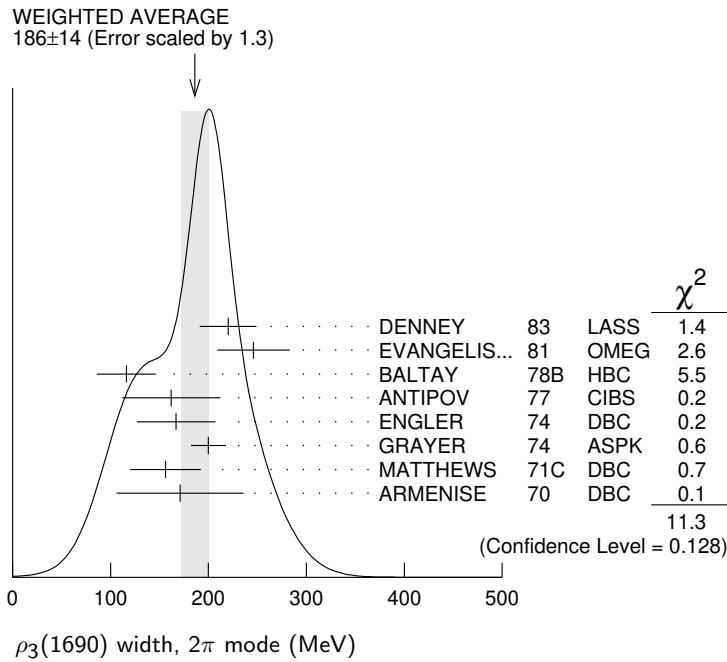
¹⁵Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶Uses same data as HYAMS 75 and BECKER 79.

¹⁷From a phase shift solution containing a $f_2'(1525)$ width two times larger than the $K\bar{K}$ result.

¹⁸From phase-shift analysis. Error takes account of spread of different phase-shift solutions.

NODE=M015W1;LINKAGE=T
NODE=M015W1;LINKAGE=G
NODE=M015W1;LINKAGE=M
NODE=M015W1;LINKAGE=I



$K\bar{K}$ AND $K\bar{K}\pi$ MODES

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

204±18 OUR AVERAGE

199±40	6000	¹⁹ MARTIN	78D	SPEC	10 $\pi^- p \rightarrow K_S^0 K^- p$
205±20		BLUM	75	ASPK	0 18.4 $\pi^- p \rightarrow n K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
219±4		ALPER	80	CNTR	0 62 $\pi^- p \rightarrow K^+ K^- n$
186±11		²⁰ COSTA	80	OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
112±60		ADERHOLZ	69	HBC	+ 8 $\pi^+ p \rightarrow K \bar{K} \pi$

¹⁹ From a fit to $J^P = 3^-$ partial wave.

²⁰ They cannot distinguish between $\rho_3(1690)$ and $\omega_3(1670)$.

NODE=M015W2
NODE=M015W2

NODE=M015W2;LINKAGE=P
NODE=M015W2;LINKAGE=L

$(4\pi)^\pm$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

129±10 OUR AVERAGE

123±13		²¹ EVANGELIS...	81	OMEG	- 12 $\pi^- p \rightarrow p 4\pi$
105±30	177	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p 4\pi$
169 ⁺⁷⁰ ₋₄₈		CASON	73	HBC	- 8,18.5 $\pi^- p$
135±30	144	BARTSCH	70B	HBC	+ 8 $\pi^+ p \rightarrow N 4\pi$
160±30	102	BARTSCH	70B	HBC	+ 8 $\pi^+ p \rightarrow N 2\rho$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
230±28		²² EVANGELIS...	81	OMEG	- 12 $\pi^- p \rightarrow p 4\pi$
184±33		²³ EVANGELIS...	81	OMEG	- 12 $\pi^- p \rightarrow p 4\pi$
150	66	²⁴ KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p 4\pi$
106±25		THOMPSON	74	HBC	+ 13 $\pi^+ p$
125 ⁺⁸³ ₋₃₅		²⁴ CASON	73	HBC	- 8,18.5 $\pi^- p$
130±30		HOLMES	72	HBC	+ 10-12 $K^+ p$
180±30	90	²⁴ BARTSCH	70B	HBC	+ 8 $\pi^+ p \rightarrow N a_2 \pi$
100±35		BALTAY	68	HBC	+ 7, 8.5 $\pi^+ p$

²¹ From $\rho^- \rho^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²² From $a_2(1320)^- \pi^0$ mode, not independent of the other two EVANGELISTA 81 entries.

²³ From $a_2(1320)^0 \pi^-$ mode, not independent of the other two EVANGELISTA 81 entries.

²⁴ From $\rho^\pm \rho^0$ mode.

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NODE=M015W3;LINKAGE=A
NODE=M015W3;LINKAGE=B
NODE=M015W3;LINKAGE=C
NODE=M015W3;LINKAGE=F

ωπ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
The data in this block is included in the average printed for a previous datablock.				

190±40 OUR AVERAGE

230±65	²⁵ ALDE	95	GAM2	38 π ⁻ p → ωπ ⁰ n
190±65	EVANGELIS...	81	OMEG -	12 π ⁻ p → ωπ p
160±56	GESSAROLI	77	HBC	11 π ⁻ p → ωπ p
• • • We do not use the following data for averages, fits, limits, etc. • • •				
89±25	THOMPSON	74	HBC +	13 π ⁺ p
130 ⁺⁷³ ₋₄₃	BARNHAM	70	HBC +	10 K ⁺ p → ωπ X
²⁵ Supersedes ALDE 92C.				

ηπ⁺π⁻ MODE

(For difficulties with MMS experiments, see the a₂(1320) mini-review in the 1973 edition.)

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
The data in this block is included in the average printed for a previous datablock.				

130±40 OUR AVERAGE Error includes scale factor of 1.8. [126 ± 40 MeV OUR 2023 AVERAGE Scale factor = 1.8]				
220±30±50	AMELIN	00	VES	37 π ⁻ p → ηπ ⁺ π ⁻ n
106±27	FUKUI	88	SPEC 0	8.95 π ⁻ p → ηπ ⁺ π ⁻ n
• • • We do not use the following data for averages, fits, limits, etc. • • •				
195	²⁶ ANDERSON	69	MMS -	16 π ⁻ p backward
< 21	^{26,27} FOCACCI	66	MMS -	7-12 π ⁻ p → pMM
< 30	^{26,27} FOCACCI	66	MMS -	7-12 π ⁻ p → pMM
< 38	^{26,27} FOCACCI	66	MMS -	7-12 π ⁻ p → pMM
²⁶ Seen in 2.5-3 GeV/c $\bar{p}p$. 2π ⁺ 2π ⁻ , with 0, 1, 2 π ⁺ π ⁻ pairs in ρ ⁰ band not seen by OREN 74 (2.3 GeV/c $\bar{p}p$) with more statistics. (Jan. 1979)				
²⁷ Not seen by BOWEN 72.				

ρ₃(1690) DECAY MODES

Mode	Fraction (Γ _i /Γ)	Scale factor
Γ ₁ 4π	(71.1 ± 1.9) %	
Γ ₂ π [±] π ⁺ π ⁻ π ⁰	(67 ±22) %	
Γ ₃ ωπ	(16 ± 6) %	
Γ ₄ ππ	(23.6 ± 1.3) %	
Γ ₅ K $\bar{K}$ π	(3.8 ± 1.2) %	
Γ ₆ K $\bar{K}$	(1.58± 0.26) %	1.2
Γ ₇ ηπ ⁺ π ⁻	seen	
Γ ₈ ρ(770)η	seen	
Γ ₉ ππρ	seen	
Γ ₁₀ a ₂ (1320)π	seen	
Γ ₁₁ ρρ	seen	
Γ ₁₂ φπ		
Γ ₁₃ ηπ		
Γ ₁₄ π [±] 2π ⁺ 2π ⁻ π ⁰		

CONSTRAINED FIT INFORMATION

An overall fit to 5 branching ratios uses 10 measurements and one constraint to determine 4 parameters. The overall fit has a χ² = 14.7 for 7 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients <δx_iδx_j>/(δx_i·δx_j), in percent, from the fit to the branching fractions, x_i ≡ Γ_i/Γ_{total}. The fit constrains the x_i whose labels appear in this array to sum to one.

x ₄	-77		
x ₅	-74	17	
x ₆	-15	2	0
	x ₁	x ₄	x ₅

NODE=M015W5
NODE=M015W5

NODE=M015W5;LINKAGE=A

NODE=M015W6
NODE=M015W6

NODE=M015W6

NEW

OCCUR=2
OCCUR=3

NODE=M015W6;LINKAGE=R

NODE=M015W6;LINKAGE=N

NODE=M015215;NODE=M015

DESIG=2
DESIG=11
DESIG=7
DESIG=1
DESIG=3
DESIG=4
DESIG=13
DESIG=14;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←
DESIG=9
DESIG=10
DESIG=12

$\rho_3(1690)$ BRANCHING RATIOS

NODE=M015220

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.236 $\pm$ 0.013 OUR FIT**0.243 $\pm$ 0.013 OUR AVERAGE**0.259 $^{+0.018}_{-0.019}$

BECKER

79

ASPK 0

17 $\pi^- p$ polarized0.23 $\pm$ 0.02

CORDEN

79

OMEG

12-15 $\pi^- p \rightarrow n 2\pi$ 0.22 $\pm$ 0.04²⁸

MATTHEWS

71C

HDBC 0

7 $\pi^+ n \rightarrow \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.245 $\pm$ 0.006²⁹

ESTABROOKS

75

RVUE

17 $\pi^- p \rightarrow \pi^+ \pi^- n$ ²⁸ One-pion-exchange model used in this estimation.²⁹ From phase-shift analysis of HYAMS 75 data.

NODE=M015R1;LINKAGE=P

NODE=M015R1;LINKAGE=G

 $\Gamma(\pi\pi)/\Gamma(\pi^\pm\pi^+\pi^-\pi^0)$ Γ_4/Γ_2

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.35 $\pm$ 0.11

CASON

73

HBC

-

8,18.5 $\pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.2

HOLMES

72

HBC

+

10-12 $K^+ p$

<0.12

BALLAM

71B

HBC

-

16 $\pi^- p$

NODE=M015R2

NODE=M015R2

 $\Gamma(\pi\pi)/\Gamma(4\pi)$ Γ_4/Γ_1

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.332 $\pm$ 0.026 OUR FIT Error includes scale factor of 1.1.**0.30 $\pm$ 0.10**

BALTAY

78B

HBC

0

15 $\pi^+ p \rightarrow p 4\pi$

NODE=M015R3

NODE=M015R3

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_6/Γ_4

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.067 $\pm$ 0.011 OUR FIT Error includes scale factor of 1.2.**0.118 $^{+0.040}_{-0.032}$ OUR AVERAGE** Error includes scale factor of 1.7. See the ideogram below.0.191 $^{+0.040}_{-0.037}$

GORLICH

80

ASPK 0

17,18 $\pi^- p$ polarized0.08 $\pm$ 0.03

BARTSCH

70B

HBC

+

8 $\pi^+ p$ 0.08 $^{+0.08}_{-0.03}$

CRENNELL

68B

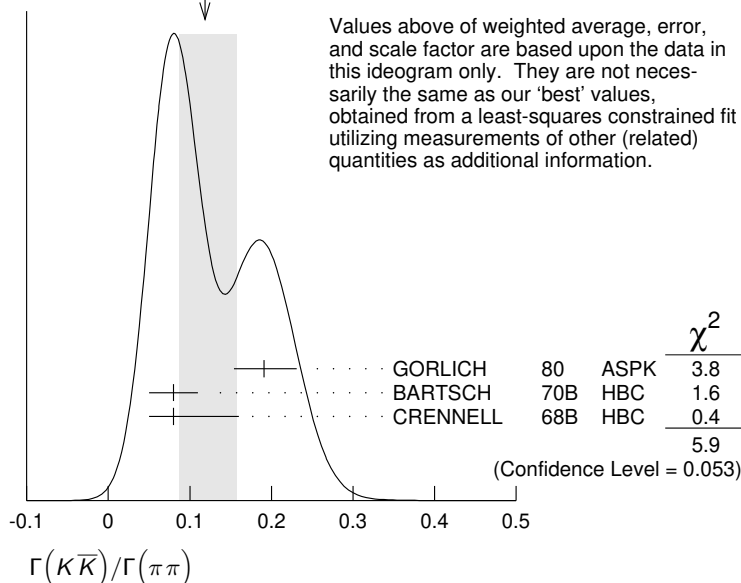
HBC

6.0 $\pi^- p$

NODE=M015R4

NODE=M015R4

WEIGHTED AVERAGE

0.118 $\pm$ 0.040-0.032 (Error scaled by 1.7) $\Gamma(K\bar{K}\pi)/\Gamma(\pi\pi)$ Γ_5/Γ_4

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

0.16 $\pm$ 0.05 OUR FIT**0.16 $\pm$ 0.05**³⁰

BARTSCH

70B

HBC

+

8 $\pi^+ p$ ³⁰ Increased by us to correspond to $B(\rho_3(1690) \rightarrow \pi\pi)=0.24$.

NODE=M015R5

NODE=M015R5

NODE=M015R5;LINKAGE=A

$$\frac{[\Gamma(\pi^+\pi^-\pi^0) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{(\Gamma_9 + \Gamma_{10} + \Gamma_{11})}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.94±0.09 OUR AVERAGE				
0.96±0.21	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.88±0.15	BALLAM	71B	HBC	- 16 $\pi^- p$
1 ±0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
consistent with 1	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R6
NODE=M015R6

$$\frac{\Gamma(\rho\rho)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{11}}{\Gamma_2}$$

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.12±0.11		BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.56	66	KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p4\pi$
0.13±0.09	31	THOMPSON	74	HBC	+ 13 $\pi^+ p$
0.7 ±0.15		BARTSCH	70B	HBC	+ 8 $\pi^+ p$

NODE=M015R7
NODE=M015R7

³¹ $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R7;LINKAGE=T

$$\frac{\Gamma(\rho\rho)}{[\Gamma(\pi^+\pi^-\pi^0) + \Gamma(a_2(1320)\pi) + \Gamma(\rho\rho)]} \quad \frac{\Gamma_{11}}{(\Gamma_9 + \Gamma_{10} + \Gamma_{11})}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.48±0.16	CASO	68	HBC	- 11 $\pi^- p$

NODE=M015R8
NODE=M015R8

$$\frac{\Gamma(a_2(1320)\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{10}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.66±0.08	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
0.36±0.14	32 THOMPSON	74	HBC	+ 13 $\pi^+ p$
not seen	CASON	73	HBC	- 8,18.5 $\pi^- p$
0.6 ±0.15	BARTSCH	70B	HBC	+ 8 $\pi^+ p$
0.6	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R9
NODE=M015R9

³² $\rho\rho$ and $a_2(1320)\pi$ modes are indistinguishable.

NODE=M015R9;LINKAGE=T

$$\frac{\Gamma(\omega\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_3}{\Gamma_2}$$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
0.23±0.05 OUR AVERAGE					Error includes scale factor of 1.2.
0.33±0.07		THOMPSON	74	HBC	+ 13 $\pi^+ p$
0.12±0.07		BALLAM	71B	HBC	- 16 $\pi^- p$
0.25±0.10		BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$
0.25±0.10		JOHNSTON	68	HBC	- 7.0 $\pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.11	95	BALTAY	78B	HBC	+ 15 $\pi^+ p \rightarrow p4\pi$
<0.09		KLIGER	74	HBC	- 4.5 $\pi^- p \rightarrow p4\pi$

NODE=M015R10
NODE=M015R10

$$\frac{\Gamma(\phi\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{12}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.11	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R11
NODE=M015R11

$$\frac{\Gamma(\pi^+2\pi^+2\pi^-\pi^0)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{14}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.15	BALTAY	68	HBC	+ 7,8.5 $\pi^+ p$

NODE=M015R12
NODE=M015R12

$$\frac{\Gamma(\eta\pi)}{\Gamma(\pi^+\pi^+\pi^-\pi^0)} \quad \frac{\Gamma_{13}}{\Gamma_2}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.02	THOMPSON	74	HBC	+ 13 $\pi^+ p$

NODE=M015R13
NODE=M015R13

$$\frac{\Gamma(K\bar{K})}{\Gamma_{\text{total}}} \quad \frac{\Gamma_6}{\Gamma}$$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.0158±0.0026 OUR FIT				Error includes scale factor of 1.2.
0.0130±0.0024 OUR AVERAGE				

NODE=M015R14
NODE=M015R14

0.013 ±0.003	COSTA	80	OMEG	0	10 $\pi^- p \rightarrow K^+ K^- n$
0.013 ±0.004	33 MARTIN	78B	SPEC	-	10 $\pi p \rightarrow K_S^0 K^- p$

³³ From $(\Gamma_4\Gamma_6)^{1/2} = 0.056 \pm 0.034$ assuming $B(\rho_3(1690) \rightarrow \pi\pi) = 0.24$.

NODE=M015R14;LINKAGE=B

$$\Gamma(\omega\pi)/[\Gamma(\omega\pi) + \Gamma(\rho\rho)]$$

VALUE

DOCUMENT ID

TECN

CHG

COMMENT

$$\Gamma_3/(\Gamma_3 + \Gamma_{11})$$

NODE=M015R16
 NODE=M015R16

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.22 ± 0.08

CASON

73

HBC

—

8,18.5 $\pi^- p$

$$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$$

VALUE

DOCUMENT ID

TECN

COMMENT

$$\Gamma_7/\Gamma$$

NODE=M015R17
 NODE=M015R17

seen

FUKUI

88

SPEC

8.95 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$$\Gamma(a_2(1320)\pi)/\Gamma(\rho(770)\eta)$$

VALUE

DOCUMENT ID

TECN

COMMENT

$$\Gamma_{10}/\Gamma_8$$

NODE=M015R18
 NODE=M015R18

5.5 ± 2.0

AMELIN

00

VES

37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$

$\rho_3(1690)$ REFERENCES

NODE=M015

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)
GORLICH	80	NP B174 16	L. Gorlich <i>et al.</i>	(CRAC, MPIM, CERN+)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
MARTIN	78B	NP B140 158	A.D. Martin <i>et al.</i>	(DURH, GEVA)
MARTIN	78D	PL 74B 417	A.D. Martin <i>et al.</i>	(DURH, GEVA)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP
ESTABROOKS	75	NP B95 322	P.G. Estabrooks, A.D. Martin	(DURH)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)
GRAYER	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)
KLIGER	74	SJNP 19 428	G.K. Kliger <i>et al.</i>	(ITEP)
Translated from YAF 19 839.				
OREN	74	NP B71 189	Y. Oren <i>et al.</i>	(ANL, OXF)
THOMPSON	74	NP B69 220	G. Thompson <i>et al.</i>	(PURD)
CASON	73	PR D7 1971	N.M. Cason <i>et al.</i>	(NDAM)
BOWEN	72	PRL 29 890	D.R. Bowen <i>et al.</i>	(NEAS, STON)
HOLMES	72	PR D6 3336	R. Holmes <i>et al.</i>	(ROCH)
BALLAM	71B	PR D3 2606	J. Ballam <i>et al.</i>	(SLAC)
MATTHEWS	71C	NP B33 1	J.A.J. Matthews <i>et al.</i>	(TNTO, WISC) JP
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
BARNHAM	70	PRL 24 1083	K.W.J. Barnham <i>et al.</i>	(BIRM)
BARTSCH	70B	NP B22 109	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN)
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)
STUNTEBECK	70	PL 32B 391	P.H. Stuntebeck <i>et al.</i>	(NDAM)
ADERHOLZ	69	NP B11 259	M. Aderholz <i>et al.</i>	(AACH3, BERL, CERN+)
ANDERSON	69	PRL 22 1390	E.W. Anderson <i>et al.</i>	(BNL, CMU)
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+) I
BALTAY	68	PRL 20 887	C. Baltay <i>et al.</i>	(COLU, ROCH, RUTG, YALE) I
CASO	68	NC 54A 983	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)
CRENNELL	68B	PL 28B 136	D.J. Crennell <i>et al.</i>	(BNL)
JOHNSTON	68	PRL 20 1414	T.F. Johnston <i>et al.</i>	(TNTO, WISC) IJP
FOCACCI	66	PRL 17 890	M.N. Focacci <i>et al.</i>	(CERN)
GOLDBERG	65	PL 17 354	M. Goldberg <i>et al.</i>	(CERN, EPOL, ORSAY+)

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 REFID=20402
 REFID=21601

$\rho(1700)$

$$J^G(J^{PC}) = 1^+(1^-)$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M065

NODE=M065

NODE=M065205

NODE=M065M0
NODE=M065M0

→ UNCHECKED ←

NODE=M065M6
NODE=M065M6 **$\rho(1700)$ MASS** **$\eta\rho^0$ AND $\pi^+\pi^-$ MODES**

VALUE (MeV)

DOCUMENT ID

1720±20 OUR ESTIMATE **$\eta\rho^0$ MODE**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

1834±12	13.4k	¹ GRIBANOV	20	CMD3	1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1840±10	7.4k	² ACHASOV	18	SND	1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$
1740±20		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
1701±15		³ FUKUI	88	SPEC	8.95 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.³ Assuming $\rho^+f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.

NODE=M065M6;LINKAGE=B

NODE=M065M6;LINKAGE=A

NODE=M065M;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

• • • We do not use the following data for averages, fits, limits, etc. • • •

1770.54±5.49		¹ BARTOS	17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1718.50±65.44		² BARTOS	17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1766.80±52.36		³ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1644 ±36	20k	⁴ LEES	17C	BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
1780 ±20	$+15$ -20	⁵ ABRAMOWICZ	12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
1861 ±17		⁶ LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
1728 ±17	±89	^{7,8} FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
1780 $+37$ -29		⁹ ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
1719 ±15		⁹ BERTIN	97C	OBLX	0.0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1730 ±30		CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1768 ±21		BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$
1745.7 ±91.9		DUBNICKA	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
1546 ±26		GESHKEN...	89	RVUE	
1650		¹⁰ ERKAL	85	RVUE	20–70 $\gamma p \rightarrow \gamma\pi$
1550 ±70		ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+\pi^-p$
1590 ±20		¹¹ ASTON	80	OMEG	20–70 $\gamma p \rightarrow p2\pi$
1600 ±10		¹² ATIYA	79B	SPEC	50 $\gamma C \rightarrow C2\pi$
1598 $+24$ -22		BECKER	79	ASPK	17 π^-p polarized
1659 ±25		¹⁰ LANG	79	RVUE	
1575		¹⁰ MARTIN	78C	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1610 ±30		¹⁰ FROGGATT	77	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
1590 ±20		¹³ HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.⁴ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.⁵ Using the KUHN 90 parametrization of the pion form factor, neglecting $p-\omega$ interference.

OCCUR=2

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NODE=M065M1;LINKAGE=D

NODE=M065M1;LINKAGE=E

NODE=M065M1;LINKAGE=A

NODE=M065M1;LINKAGE=AB

⁶ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁷ $|F_\pi(0)|^2$ fixed to 1.

⁸ From the GOUNARIS 68 parametrization of the pion form factor.

⁹ T-matrix pole.

¹⁰ From phase shift analysis of HYAMS 73 data.

¹¹ Simple relativistic Breit-Wigner fit with constant width.

¹² An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

¹³ Included in BECKER 79 analysis.

$\pi\omega$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1723 ± 2		¹ ACHASOV	23A	SND	$e^+e^- \rightarrow \omega\pi^0$
1708 ± 41	7815	² ACHASOV	13	SND	1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1550 to 1620		³ ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710		⁴ ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710 ± 90		ACHASOV	97	RVUE	$e^+e^- \rightarrow \omega\pi^0$

¹ From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

³ Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00i on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.

⁴ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00i on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1688.7 ± 3.1 ^{+141.1} _{-1.3}		¹ ALBRECHT	20	RVUE	0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
1541 ± 12 ± 33	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1740.8 ± 22.2	27k	³ ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
1582 ± 36	1600	CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ T-matrix pole, 2 poles, 3 channels, including $\pi\pi$ scattering data from HYAMS 75.

² Using the GOUNARIS 68 parameterization with a fixed width. Value is average using different $K\pi$ S-wave parametrizations in fit.

³ K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

$2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1851 ⁺²⁷ ₋₂₄		ACHASOV	97	RVUE	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1570 ± 20		¹ CORDIER	82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1520 ± 30		² ASTON	81E	OMEG	20–70 $\gamma p \rightarrow p4\pi$
1654 ± 25		³ DIBIANCA	81	DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
1666 ± 39		¹ BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1780	34	KILLIAN	80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
1500		⁴ ATIYA	79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
1570 ± 60	65	⁵ ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p4\pi$
1550 ± 60		² CONVERSI	74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
1550 ± 50	160	SCHACHT	74	STRC	5.5–9 $\gamma p \rightarrow p4\pi$
1450 ± 100	340	SCHACHT	74	STRC	9–18 $\gamma p \rightarrow p4\pi$
1430 ± 50	400	BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

¹ Simple relativistic Breit-Wigner fit with model dependent width.

² Simple relativistic Breit-Wigner fit with constant width.

³ One peak fit result.

⁴ Parameters roughly estimated, not from a fit.

⁵ Skew mass distribution compensated by Ross-Stodolsky factor.

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OCCUR=2

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 NODE=M065M;LINKAGE=O
 NODE=M065M;LINKAGE=C
 NODE=M065M;LINKAGE=D

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1660 ± 30	ATKINSON	85B	OMEG 20-70 γp

NODE=M065M5
NODE=M065M5

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1730 ± 34	¹ FRABETTI	04	E687 $\gamma p \rightarrow 3\pi^+ 3\pi^- p$
1783 ± 15	CLEGG	90	RVUE $e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

NODE=M065M7
NODE=M065M7

¹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M;LINKAGE=PI

 $m_{\rho(1700)^0} - m_{\rho(1700)^\pm}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
-48.30 ± 83.81	¹ BARTOS	17A	RVUE $e^+e^- \rightarrow \pi^+\pi^-$, $\tau^- \rightarrow \pi^-\pi^0\nu_\tau$

NODE=M065DM

NODE=M065DM

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

NODE=M065DM;LINKAGE=A

 $\rho(1700)$ WIDTH

NODE=M065210

 $\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)	DOCUMENT ID
250 ± 100 OUR ESTIMATE	

NODE=M065W0
NODE=M065W0

→ UNCHECKED ←

 $\eta\rho^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				

NODE=M065W6
NODE=M065W6

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

47 ± 19	13.4k	¹ GRIBANOV	20	CMD3	$1.1-2.0 e^+e^- \rightarrow \eta\pi^+\pi^-$
132 ± 40	7.4k	² ACHASOV	18	SND	$1.22-2.00 e^+e^- \rightarrow \eta\pi^+\pi^-$
150 ± 30		ANTONELLI	88	DM2	$e^+e^- \rightarrow \eta\pi^+\pi^-$
282 ± 44		³ FUKUI	88	SPEC	$8.95 \pi^- p \rightarrow \eta\pi^+\pi^- n$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

NODE=M065W6;LINKAGE=B

² From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M065W6;LINKAGE=A

³ Assuming $\rho^+ f_0(1370)$ decay mode interferes with $a_1(1260)^+\pi$ background. From a two Breit-Wigner fit.

NODE=M065W;LINKAGE=B

 $\pi\pi$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.				

NODE=M065W1
NODE=M065W1

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

268.98 ± 11.40		¹ BARTOS	17	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
489.58 ± 16.95		² BARTOS	17A	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
414.71 ± 119.48		³ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
109 ± 19	20k	⁴ LEES	17C	BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
310 ± 30	$+25/-35$ 63.5k	⁵ ABRAMOWICZ	12	ZEUS	$ep \rightarrow e\pi^+\pi^-p$
316 ± 26		⁶ LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 ± 21	$+89/-26$ 5.4M	^{7,8} FUJIKAWA	08	BELL	$\tau^- \rightarrow \pi^-\pi^0\nu_\tau$
275 ± 45		⁹ ABELE	97	CBAR	$\bar{p}n \rightarrow \pi^-\pi^0\pi^0$
310 ± 40		⁹ BERTIN	97C	OBLX	$0.0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0$
400 ± 100		CLEGG	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
224 ± 22		BISELLO	89	DM2	$e^+e^- \rightarrow \pi^+\pi^-$

OCCUR=2

242.5 ± 163.0	DUBNICKA	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
620 ± 60	GESHKEN...	89	RVUE	
<315	10 ERKAL	85	RVUE	20–70 $\gamma p \rightarrow \gamma\pi$
280 + 30 – 80	ABE	84B	HYBR	20 $\gamma p \rightarrow \pi^+\pi^-p$
230 ± 80	11 ASTON	80	OMEG	20–70 $\gamma p \rightarrow p2\pi$
283 ± 14	12 ATIYA	79B	SPEC	50 $\gamma C \rightarrow C2\pi$
175 + 98 – 53	BECKER	79	ASPK	17 π^-p polarized
232 ± 34	10 LANG	79	RVUE	
340	10 MARTIN	78C	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
300 ± 100	10 FROGGATT	77	RVUE	17 $\pi^-p \rightarrow \pi^+\pi^-n$
180 ± 50	13 HYAMS	73	ASPK	17 $\pi^-p \rightarrow \pi^+\pi^-n$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

² Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, and AMBROSINO 11A.

³ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of FUJIKAWA 08.

⁴ From a Dalitz plot analysis in an isobar model with $\rho(1450)$ and $\rho(1700)$ masses and widths floating.

⁵ Using the KUHN 90 parametrization of the pion form factor, neglecting $\rho-\omega$ interference.

⁶ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

⁷ $|F_\pi(0)|^2$ fixed to 1.

⁸ From the GOUNARIS 68 parametrization of the pion form factor.

⁹ T-matrix pole.

¹⁰ From phase shift analysis of HYAMS 73 data.

¹¹ Simple relativistic Breit-Wigner fit with constant width.

¹² An additional 40 MeV uncertainty in both the mass and width is present due to the choice of the background shape.

¹³ Included in BECKER 79 analysis.

NODE=M065W1;LINKAGE=C

NODE=M065W1;LINKAGE=D

NODE=M065W1;LINKAGE=E

NODE=M065W1;LINKAGE=A

NODE=M065W1;LINKAGE=AB

NODE=M065W1;LINKAGE=LE

NODE=M065W1;LINKAGE=FU

NODE=M065W1;LINKAGE=GO

NODE=M065W;LINKAGE=QQ

NODE=M065W;LINKAGE=P

NODE=M065W;LINKAGE=M

NODE=M065W;LINKAGE=R

NODE=M065W;LINKAGE=H

NODE=M065W2

NODE=M065W2

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

150.9 ± 2.5 ⁺⁶⁰ _{–10.6}	1 ALBRECHT	20	RVUE		0.9 $\bar{p}p \rightarrow K^+K^-\pi^0$
187.2 ± 26.7	27k	2 ABELE	99D	CBAR ±	0.0 $\bar{p}p \rightarrow K^+K^-\pi^0$
265 ± 120	1600	CLELAND	82B	SPEC ±	50 $\pi p \rightarrow K_S^0 K^\pm p$

¹ T-matrix pole, 2 poles, 3 channels, including $\pi\pi$ scattering data from HYAMS 75.

² K-matrix pole. Isospin not determined, could be $\omega(1650)$ or $\phi(1680)$.

NODE=M065W2;LINKAGE=A

NODE=M065W2;LINKAGE=AN

$2(\pi^+\pi^-)$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

510 ± 40	1 CORDIER	82	DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 50	2 ASTON	81E	OMEG	20–70 $\gamma p \rightarrow p4\pi$
400 ± 146	3 DIBIANCA	81	DBC	$\pi^+d \rightarrow pp2(\pi^+\pi^-)$
700 ± 160	1 BACCI	80	FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
100	34 KILLIAN	80	SPEC	11 $e^-p \rightarrow 2(\pi^+\pi^-)$
600	4 ATIYA	79B	SPEC	50 $\gamma C \rightarrow C4\pi^\pm$
340 ± 160	65 ALEXANDER	75	HBC	7.5 $\gamma p \rightarrow p4\pi$
360 ± 100	2 CONVERSI	74	OSPK	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
400 ± 120	160 SCHACHT	74	STRC	5.5–9 $\gamma p \rightarrow p4\pi$
850 ± 200	340 SCHACHT	74	STRC	9–18 $\gamma p \rightarrow p4\pi$
650 ± 100	400 BINGHAM	72B	HBC	9.3 $\gamma p \rightarrow p4\pi$

¹ Simple relativistic Breit-Wigner fit with model-dependent width.

² Simple relativistic Breit-Wigner fit with constant width.

³ One peak fit result.

⁴ Parameters roughly estimated, not from a fit.

⁵ Skew mass distribution compensated by Ross-Stodolsky factor.

⁶ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M065W4

NODE=M065W4

OCCUR=2

NODE=M065W;LINKAGE=A

NODE=M065W4;LINKAGE=M

NODE=M065W;LINKAGE=O

NODE=M065W;LINKAGE=C

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NODE=M065W;LINKAGE=E

$\pi^+\pi^-\pi^0\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

300 ± 50	ATKINSON	85B	OMEG	20–70 γp

NODE=M065W5

NODE=M065W5

$\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
371±3	¹ ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
350 to 580	² ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	³ ACHASOV	00I SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

² Taking into account both $\rho(1450)$ and $\rho(1700)$ contributions. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$. $\rho(1450)$ mass and width fixed at 1400 MeV and 500 MeV respectively.

³ Taking into account the $\rho(1700)$ contribution only. Using the data of ACHASOV 00I on $e^+e^- \rightarrow \omega\pi^0$ and of EDWARDS 00A on $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

 $3(\pi^+\pi^-)$ AND $2(\pi^+\pi^-\pi^0)$ MODES

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
315±100	¹ FRABETTI	04 E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
285±20	CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-)2(\pi^+\pi^-\pi^0)$

¹ From a fit with two resonances with the JACOB 72 continuum.

$$\Gamma_{\rho(1700)^0} = \Gamma_{\rho(1700)^\pm}$$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
74.87±120.67	¹ BARTOS	17A RVUE	$e^+e^- \rightarrow \pi^+\pi^-, \tau^- \rightarrow \pi^-\pi^0\nu_\tau$

¹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUB-NICKA 10 to analyze the data of ACHASOV 06, AKHMETSHIN 07, AUBERT 09AS, AMBROSINO 11A, and FUJIKAWA 08.

 $\rho(1700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2(\pi^+\pi^-)$	seen
Γ_3 $\rho\pi\pi$	seen
Γ_4 $\rho^0\pi^+\pi^-$	seen
Γ_5 $\rho^0\pi^0\pi^0$	
Γ_6 $\rho^\pm\pi^\mp\pi^0$	seen
Γ_7 $a_1(1260)\pi$	seen
Γ_8 $h_1(1170)\pi$	seen
Γ_9 $\pi(1300)\pi$	seen
Γ_{10} $\rho\rho$	seen
Γ_{11} $\pi^+\pi^-$	seen
Γ_{12} $\pi\pi$	seen
Γ_{13} $K\bar{K}^*(892)+c.c.$	seen
Γ_{14} $\eta\rho$	seen
Γ_{15} $a_2(1320)\pi$	not seen
Γ_{16} $K\bar{K}$	seen
Γ_{17} e^+e^-	seen
Γ_{18} $\pi^0\omega$	seen
Γ_{19} $\pi^0\gamma$	not seen
Γ_{20} $f_0(1500)\gamma$	not seen

$$\rho(1700) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the cross-section into channel_i in e^+e^- annihilation.

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.6 ±0.2	DELCOURT	81B DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
2.83±0.42	BACCI	80 FRAG	$e^+e^- \rightarrow 2(\pi^+\pi^-)$

NODE=M065W9
NODE=M065W9

OCCUR=2

NODE=M065W9;LINKAGE=A

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

NODE=M065W7
NODE=M065W7

NODE=M065W;LINKAGE=PI

NODE=M065DW

NODE=M065DW

NODE=M065DW;LINKAGE=A

NODE=M065215;NODE=M065

DESIG=20

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=15;OUR EST;→ UNCHECKED ←

DESIG=16;OUR EST;→ UNCHECKED ←

DESIG=17;OUR EST;→ UNCHECKED ←

DESIG=18;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EST;→ UNCHECKED ←

DESIG=14;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=194

DESIG=195

NODE=M065225

NODE=M065225

NODE=M065G2
NODE=M065G2

$$\Gamma_2\Gamma_{17}/\Gamma$$

$$\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{11}\Gamma_{17}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.13	¹ DIEKMAN	88	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
0.029 ^{+0.016} _{-0.012}	KURDADZE	83	OLYA 0.64–1.4 $e^+e^- \rightarrow \pi^+\pi^-$

¹ Using total width = 220 MeV.

NODE=M065G4
NODE=M065G4

NODE=M065G4;LINKAGE=B

$$\Gamma(K\bar{K}^*(892)+c.c.) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{13}\Gamma_{17}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.305±0.071	¹ BIZOT	80	DM1 e^+e^-

¹ Model dependent.

NODE=M065G10
NODE=M065G10

NODE=M065G;LINKAGE=M

$$\Gamma(\eta\rho) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{14}\Gamma_{17}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.35±0.53±0.08	13.4k	¹ GRIBANOV	20	CMD3 1.1–2.0 $e^+e^- \rightarrow \eta\pi^+\pi^-$
84 ±26 ±4		² LEES	18	BABR $e^+e^- \rightarrow \eta\pi^+\pi^-$
7 ±3		ANTONELLI	88	DM2 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ Mass and width of the $\rho(770)$ fixed at 775 and 149 MeV, respectively; solution 2 of model 2, $\eta \rightarrow \gamma\gamma$ decays used.

² Includes non-resonant contribution. The selected fit model includes three ρ excited states. Model uncertainty is 80%.

NODE=M065G11
NODE=M065G11

NODE=M065G11;LINKAGE=B

NODE=M065G11;LINKAGE=A

$$\Gamma(K\bar{K}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{16}\Gamma_{17}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.035±0.029	¹ BIZOT	80	DM1 e^+e^-

¹ Model dependent.

NODE=M065G5
NODE=M065G5

NODE=M065G5;LINKAGE=M

$$\Gamma(\rho\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_3\Gamma_{17}/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.510±0.090	¹ BIZOT	80	DM1 e^+e^-

¹ Model dependent.

NODE=M065G12
NODE=M065G12

NODE=M065G12;LINKAGE=M

$$\rho(1700) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M065240

$$\Gamma(\pi^0\omega)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma \times \Gamma_{17}/\Gamma$$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.09±0.05	10.2k	¹ ACHASOV	16D	SND 1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
1.7 ±0.4	7815	² ACHASOV	13	SND 1.05–2.00 $e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ From a phenomenological model based on vector meson dominance with interfering $\rho(700)$, $\rho(1450)$, and $\rho(1700)$. The $\rho(1700)$ mass and width are fixed at 1720 MeV and 250 MeV, respectively. Systematic uncertainty not estimated. Supersedes ACHASOV 13.

² From a phenomenological model based on vector meson dominance with the interfering $\rho(1450)$ and $\rho(1700)$ and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

NODE=M065R01
NODE=M065R01

OCCUR=4

NODE=M065R01;LINKAGE=B

NODE=M065R01;LINKAGE=AC

$$\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{14}/\Gamma \times \Gamma_{17}/\Gamma$$

VALUE (units 10 ⁻⁸)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.3 ^{+3.8} _{-3.1}	7.4k	¹ ACHASOV	18	SND 1.22–2.00 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹ From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering $\rho(1450)$, $\rho(1700)$ and $\rho(2150)$ with the parameters of the $\rho(1450)$ and $\rho(1700)$ floating and the mass and width of the $\rho(2150)$ fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π , 0 and π , respectively.

NODE=M065R00
NODE=M065R00

NODE=M065R00;LINKAGE=A

$\rho(1700)$ BRANCHING RATIOS **$\Gamma(\rho\pi\pi)/\Gamma(4\pi)$**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.28 ± 0.06	¹ ABELE	01B CBAR	$0.0 \bar{p}n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

 Γ_3/Γ_1

NODE=M065230

NODE=M065R19
NODE=M065R19

NODE=M065R;LINKAGE=BL

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$

VALUE	EVS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1.0		DELCOURT	81B DM1	$e^+e^- \rightarrow 2(\pi^+\pi^-)$
0.7 ± 0.1	500	SCHACHT	74 STRC	$5.5-18 \gamma p \rightarrow p4\pi$
0.80		¹ BINGHAM	72B HBC	$9.3 \gamma p \rightarrow p4\pi$
¹ The $\pi\pi$ system is in S-wave.				

 Γ_4/Γ_2 NODE=M065R1
NODE=M065R1

NODE=M065R1;LINKAGE=S

 $\Gamma(\rho^0\pi^0\pi^0)/\Gamma(\rho^\pm\pi^\mp\pi^0)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.10	ATKINSON	85B OMEG		$20-70 \gamma p$
< 0.15	ATKINSON	82 OMEG	0	$20-70 \gamma p \rightarrow p4\pi$

 Γ_5/Γ_6 NODE=M065R6
NODE=M065R6 **$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.16 ± 0.05	¹ ABELE	01B CBAR	$0.0 \bar{p}n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

 Γ_7/Γ_1 NODE=M065R15
NODE=M065R15

NODE=M065R15;LINKAGE=BL

 $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 ± 0.06	¹ ABELE	01B CBAR	$0.0 \bar{p}n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

 Γ_8/Γ_1 NODE=M065R16
NODE=M065R16

NODE=M065R16;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.10	¹ ABELE	01B CBAR	$0.0 \bar{p}n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

 Γ_9/Γ_1 NODE=M065R17
NODE=M065R17

NODE=M065R17;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.09 ± 0.03	¹ ABELE	01B CBAR	$0.0 \bar{p}n \rightarrow 5\pi$
¹ $\omega\pi$ not included.			

 Γ_{10}/Γ_1 NODE=M065R18
NODE=M065R18

NODE=M065R18;LINKAGE=BL

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.108 \pm 0.017^{+0.162}_{-0.004}$	¹ ALBRECHT	20 RVUE	$0.9 \bar{p}p \rightarrow K^+K^-\pi^0$
$0.287^{+0.043}_{-0.042}$	BECKER	79 ASPK	$17 \pi^- p$ polarized
0.15 to 0.30	² MARTIN	78C RVUE	$17 \pi^- p \rightarrow \pi^+\pi^-n$
< 0.20	³ COSTA...	77B RVUE	$e^+e^- \rightarrow 2\pi, 4\pi$
0.30 ± 0.05	² FROGGATT	77 RVUE	$17 \pi^- p \rightarrow \pi^+\pi^-n$
< 0.15	⁴ EISENBERG	73 HBC	$5 \pi^+ p \rightarrow \Delta^{++}2\pi$
0.25 ± 0.05	⁵ HYAMS	73 ASPK	$17 \pi^- p \rightarrow \pi^+\pi^-n$

 Γ_{11}/Γ NODE=M065R5
NODE=M065R5

¹ Residue from T-matrix pole, 2 poles, 3 channels, Chew-Mandelstam functions and simplified analytic continuation for the 4π channel. Includes scattering data from HYAMS 75 and model-independent calculation of GARCIA-MARTIN 11A.

² From phase shift analysis of HYAMS 73 data.

³ Estimate using unitarity, time reversal invariance, Breit-Wigner.

⁴ Estimated using one-pion-exchange model.

⁵ Included in BECKER 79 analysis.

NODE=M065R5;LINKAGE=A

NODE=M065R5;LINKAGE=P

NODE=M065R5;LINKAGE=C

NODE=M065R5;LINKAGE=E

NODE=M065R5;LINKAGE=H

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.007 \pm 0.006^{+0.041}_{-0.002}$	¹ ALBRECHT	20	RVUE	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

¹ Residue from T-matrix pole, 2 poles, 3 channels, Chew-Mandelstam functions and simplified analytic continuation for the 4π channel. Includes scattering data from HYAMS 75 and model-independent calculation of GARCIA-MARTIN 11A.

 Γ_{16}/Γ

NODE=M065R03
NODE=M065R03

NODE=M065R03;LINKAGE=A

 $\Gamma(\pi^+ \pi^-)/\Gamma(2(\pi^+ \pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13 ± 0.05	ASTON	80	OMEG	$20-70 \gamma p \rightarrow p 2\pi$
< 0.14	¹ DAVIER	73	STRC	$6-18 \gamma p \rightarrow p 4\pi$
< 0.2	² BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p 2\pi$

¹ Upper limit is estimate.

² 2σ upper limit.

 Γ_{11}/Γ_2

NODE=M065R3
NODE=M065R3

NODE=M065R3;LINKAGE=E
NODE=M065R3;LINKAGE=S

 $\Gamma(\pi\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.16 ± 0.04	^{1,2} ABELE	01B	CBAR	$0.0 \bar{p} n \rightarrow 5\pi$

¹ Using ABELE 97.

² $\omega\pi$ not included.

 Γ_{12}/Γ_1

NODE=M065R20
NODE=M065R20

NODE=M065R;LINKAGE=LK
NODE=M065R20;LINKAGE=BL

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	COAN	04	CLEO	$\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$

 Γ_{13}/Γ

NODE=M065R21
NODE=M065R21

 $\Gamma(K\bar{K}^*(892) + \text{c.c.})/\Gamma(2(\pi^+ \pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.15 ± 0.03	¹ DELCOURT	81B	DM1	$e^+ e^- \rightarrow \bar{K} K \pi$

¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

 Γ_{13}/Γ_2

NODE=M065R9
NODE=M065R9

NODE=M065R9;LINKAGE=D

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen		AKHMETSHIN	00D	CMD2	$e^+ e^- \rightarrow \eta \pi^+ \pi^-$
< 0.04		DONNACHIE	87B	RVUE	
< 0.02	58	ATKINSON	86B	OMEG	$20-70 \gamma p$

 Γ_{14}/Γ

NODE=M065R12
NODE=M065R12

 $\Gamma(\eta\rho)/\Gamma(2(\pi^+ \pi^-))$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.123 ± 0.027	DELCOURT	82	DM1	$e^+ e^- \rightarrow \pi^+ \pi^- \text{MM}$
~ 0.1	ASTON	80	OMEG	$20-70 \gamma p$

 Γ_{14}/Γ_2

NODE=M065R8
NODE=M065R8

 $\Gamma(\pi^+ \pi^- \text{ neutrals})/\Gamma(2(\pi^+ \pi^-))$ $(\Gamma_5 + \Gamma_6 + 0.714\Gamma_{14})/\Gamma_2$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.6 ± 0.4	¹ BALLAM	74	HBC	$9.3 \gamma p$

¹ Upper limit. Background not subtracted.

NODE=M065R7
NODE=M065R7

NODE=M065R7;LINKAGE=U

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AMELIN	00	VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

 Γ_{15}/Γ

NODE=M065R14
NODE=M065R14

 $\Gamma(K\bar{K})/\Gamma(2(\pi^+ \pi^-))$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.015 ± 0.010		¹ DELCOURT	81B	DM1	$e^+ e^- \rightarrow \bar{K} K$
< 0.04	95	BINGHAM	72B	HBC	$0 \quad 9.3 \gamma p$

¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

 Γ_{16}/Γ_2

NODE=M065R4
NODE=M065R4

NODE=M065R4;LINKAGE=D

$\Gamma(K\bar{K})/\Gamma(K\bar{K}^*(892)+c.c.)$ Γ_{16}/Γ_{13}

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.052 ± 0.026	BUON	82	DM1	$e^+e^- \rightarrow \text{hadrons}$

NODE=M065R10
 NODE=M065R10

 $\Gamma(\pi^0\omega)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen		MATVIENKO	15	BELL	$\bar{B}^0 \rightarrow D^{*+}\omega\pi^-$
seen	1.6k	ACHASOV	12	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
not seen	2382	AKHMETSHIN	03B	CMD2	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
seen		ACHASOV	97	RVUE	$e^+e^- \rightarrow \omega\pi^0$

NODE=M065R13
 NODE=M065R13

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	¹ ACHASOV	10D	SND	1.075–2.0 $e^+e^- \rightarrow \pi^0\gamma$

¹ From a fit of a VMD model with two effective resonances with masses of 1450 MeV and 1700 MeV to describe the excited vector states $\omega(1420)$, $\rho(1450)$, $\omega(1650)$, and $\rho(1700)$. The width of the highest mass effective resonance is fixed at 315 MeV.

NODE=M065R02
 NODE=M065R02

NODE=M065R02;LINKAGE=A

 $\Gamma(f_0(1500)\gamma)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	¹ ACHASOV	22	SND	1.17–2.00 $e^+e^- \rightarrow \eta\eta\gamma$

¹ The 90% CL upper limit on the Born cross sections $\sigma(e^+e^- \rightarrow \phi(1680) \rightarrow f'_2(1525)\gamma \rightarrow \eta\eta\gamma)$ and $\sigma(e^+e^- \rightarrow \rho(1700) \rightarrow f_0(1500)\gamma \rightarrow \eta\eta\gamma)$ is 10.6 pb.

NODE=M065R04
 NODE=M065R04

NODE=M065R04;LINKAGE=A

 $\rho(1700)$ REFERENCES

NODE=M065

ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)
ACHASOV	22	EPJ C82 168	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
GRIBANOV	20	JHEP 2001 112	S.S. Gribov <i>et al.</i>	(CMD-3 Collab.)
ACHASOV	18	PR D97 012008	M.N. Achasov <i>et al.</i>	(SND Collab.)
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BARTOS	17	PR D96 113004	E. Bartos <i>et al.</i>	
BARTOS	17A	IJMP A32 1750154	E. Bartos <i>et al.</i>	
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	16C	PL B753 629	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	16D	PR D94 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)
AULCHENKO	15	PR D91 052013	V.M. Aulchenko <i>et al.</i>	(SND Collab.)
MATVIENKO	15	PR D92 012013	D. Matvienko <i>et al.</i>	(BELLE Collab.)
ACHASOV	13	PR D88 054013	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABRAMOWICZ	12	EPJ C72 1869	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
ACHASOV	12	JETPL 94 734	M.N. Achasov <i>et al.</i>	
Translated from ZETFP 94 796.				
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)
ACHASOV	10D	PR D98 112001	M.N. Achasov <i>et al.</i>	(SND Collab.)
DUBNICKA	10	APS 60 1	S. Dubnicka, A.Z. Dubnickova	
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)
FUJIKAWA	08	PR D78 072006	M. Fujikawa <i>et al.</i>	(BELLE Collab.)
AKHMETSHIN	07	PL B648 28	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ACHASOV	06	JETP 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
Translated from ZETF 130 437.				
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	00I	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)
ATKINSON	86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ATKINSON	85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)
ABE	84B	PRL 53 751	K. Abe <i>et al.</i>	(SLAC HFP Collab.)
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)
Translated from ZETFP 37 613.				

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ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parada	(GRAZ)
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP
JACOB	72	PR D5 1847	M. Jacob, R. Slansky	
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

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NODE=M162

$a_2(1700)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

$a_2(1700)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1630–1780) – i (60–250) OUR ESTIMATE			
$(1686 \pm 22^{+19}_{-7}) - i(211 \pm 38^{+32}_{-29})$	¹ KOPF	21	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^- \text{ and } 191 \pi^- p \rightarrow \pi^- \pi^- \pi^+ p$
$(1638.9 \pm 2.3^{+57.4}_{-0.1}) - i(112.0 \pm 1.3^{+0.9}_{-24.2})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1722 \pm 15 \pm 67) - i(124 \pm 9 \pm 32)$	³ RODAS	19	RVUE $191 \pi^- p \rightarrow \eta' \pi^- p$
$(1698 \pm 44) - i(133 \pm 28)$	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \eta \eta$

¹ Based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi$, $\eta'\pi$ and $K\bar{K}$ systems.

² Based on 2 poles, 2 channels ($\eta\pi$, $K\bar{K}$).

³ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15 data.

NODE=M162PP

NODE=M162PP

NODE=M162PP

→ UNCHECKED ←

NODE=M162PP;LINKAGE=A

NODE=M162PP;LINKAGE=B

NODE=M162PP;LINKAGE=C

$a_2(1700)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1706±14 OUR AVERAGE				
Error includes scale factor of 1.2.				
1681^{+22}_{-35}	46M	^{1,2} AGHASYAN	18B	COMP $190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$1726 \pm 12 \pm 25$		² ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
$1722 \pm 9 \pm 15$	18k	³ SCHEGELSKY	06	RVUE $\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$
1660 ± 40		² ABELE	99B	CBAR $1.94 \bar{p}p \rightarrow \pi^0 \eta \eta$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$1720 \pm 10 \pm 60$		⁴ JACKURA	18	RVUE $\pi^- p \rightarrow \eta \pi^- p$
1675 ± 25		ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
1702 ± 7	80k	⁵ UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta \eta \pi^0$
$1721 \pm 13 \pm 44$	145k	LU	05	B852 $18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1737 \pm 5 \pm 7$		ABE	04	BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1767 ± 14	221	⁶ ACCIARRI	01H	L3 $\gamma \gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$
~ 1775		⁷ GRYGOREV	99	SPEC $40 \pi^- p \rightarrow K_S^0 K_S^0 n$
$1752 \pm 21 \pm 4$		ACCIARRI	97T	L3 $\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$

NODE=M162M

NODE=M162M

¹ Statistical error negligible.
² Breit-Wigner mass.
³ From analysis of L3 data at 183–209 GeV.
⁴ Superseded by RODAS 19.
⁵ Statistical error only.
⁶ Spin 2 dominant, isospin not determined, could also be $I=1$.
⁷ Possibly two $J^P = 2^+$ resonances with isospins 0 and 1.

NODE=M162M;LINKAGE=B
NODE=M162M;LINKAGE=E
NODE=M162M;LINKAGE=SC
NODE=M162M;LINKAGE=D
NODE=M162M;LINKAGE=ST
NODE=M162M;LINKAGE=HA
NODE=M162M;LINKAGE=GR

$a_2(1700)$ WIDTH

NODE=M162W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M162W

380^{+60}_{-50} OUR AVERAGE Error includes scale factor of 3.9. See the ideogram below.

NEW

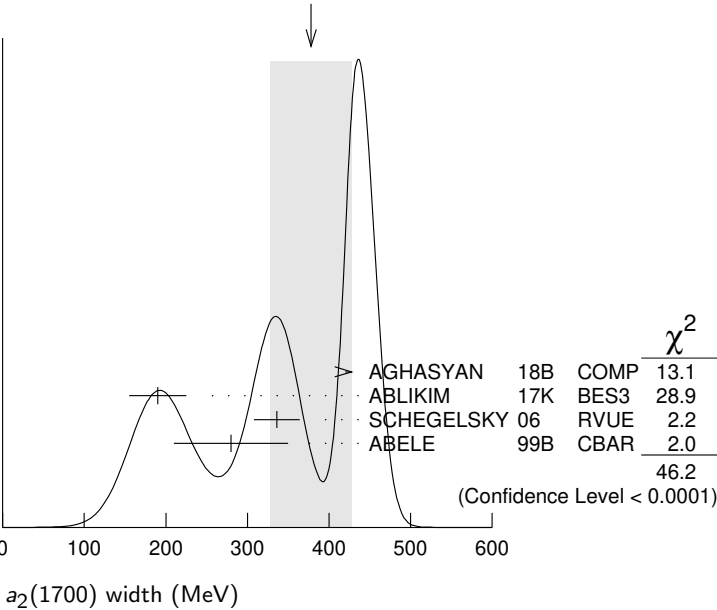
[378^{+60}_{-50} MeV OUR 2023 AVERAGE Scale factor = 3.9]

436^{+20}_{-16}	46M	^{1,2} AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$190 \pm 18 \pm 30$		² ABLIKIM	17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
$336 \pm 20 \pm 20$	18k	³ SCHEGELSKY	06	RVUE	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$
280 ± 70		² ABELE	99B	CBAR	$1.94 \bar{p} p \rightarrow \pi^0 \eta \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$280 \pm 10 \pm 70$		⁴ JACKURA	18	RVUE	$\pi^- p \rightarrow \eta \pi^- p$
270^{+50}_{-20}		ANISOVICH	09	RVUE	$0.0 \bar{p} p, \pi N$
417 ± 19	80k	⁵ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
$279 \pm 49 \pm 66$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$151 \pm 22 \pm 24$		ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
187 ± 60	221	⁶ ACCIARRI	01H	L3	$\gamma \gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
$150 \pm 110 \pm 34$		ACCIARRI	97T	L3	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$

NODE=M162W;LINKAGE=B
NODE=M162W;LINKAGE=E
NODE=M162W;LINKAGE=SC
NODE=M162W;LINKAGE=D
NODE=M162W;LINKAGE=ST
NODE=M162W;LINKAGE=HA

¹ Statistical error negligible.
² Breit-Wigner width.
³ From analysis of L3 data at 183–209 GeV.
⁴ Superseded by RODAS 19.
⁵ Statistical error only.
⁶ Spin 2 dominant, isospin not determined, could also be $I=1$.

WEIGHTED AVERAGE
 $380+60-50$ (Error scaled by 3.9)



$a_2(1700)$ DECAY MODES

NODE=M162215;NODE=M162

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta\pi$	$(2.5 \pm 0.6) \%$
$\Gamma_2 \quad \eta'\pi$	seen
$\Gamma_3 \quad \gamma\gamma$	$(7.9 \pm 1.7) \times 10^{-7}$
$\Gamma_4 \quad \rho\pi$	seen
$\Gamma_5 \quad f_2(1270)\pi$	seen
$\Gamma_6 \quad K\bar{K}$	$(1.3 \pm 0.8) \%$
$\Gamma_7 \quad \omega\pi^-\pi^0$	seen
$\Gamma_8 \quad \omega\rho$	seen

DESIG=4

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

 $a_2(1700)$ PARTIAL WIDTHS

NODE=M162220

$\Gamma(\eta\pi)$					Γ_1
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
9.5 ± 2.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M162W3
NODE=M162W3

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W3;LINKAGE=SC

$\Gamma(\gamma\gamma)$					Γ_3
<u>VALUE (keV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.30±0.05	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M162W2
NODE=M162W2

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W2;LINKAGE=SC

$\Gamma(K\bar{K})$					Γ_6
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
5.0±3.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M162W1
NODE=M162W1

¹ From analysis of L3 data at 91 and 183–209 GeV, using $a_2(1700)$ mass of 1730 MeV and width of 340 MeV, and SU(3) relations.

NODE=M162W1;LINKAGE=SC

 $a_2(1700)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M162225

$[\Gamma(\rho\pi) + \Gamma(f_2(1270)\pi)] \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$(\Gamma_4 + \Gamma_5)\Gamma_3/\Gamma$
<u>VALUE (keV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.29±0.04±0.02		ACCIARRI	97T L3	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.37^{+0.12}_{-0.08} \pm 0.10$	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

NODE=M162G1
NODE=M162G1

¹ From analysis of L3 data at 183–209 GeV.

NODE=M162G1;LINKAGE=SC

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_6\Gamma_3/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$20.6 \pm 4.2 \pm 4.6$	¹ ABE	04	BELL	$10.6 e^+e^- \rightarrow e^+e^- K^+K^-$
$49 \pm 11 \pm 13$	² ACCIARRI	01H	L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$

NODE=M162G2
NODE=M162G2

¹ Assuming spin 2.

² Spin 2 dominant, isospin not determined, could also be $I=1$.

NODE=M162G2;LINKAGE=AB
NODE=M162G;LINKAGE=HA **$a_2(1700)$ BRANCHING RATIOS**

NODE=M162235

$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$					Γ_4/Γ_5
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$3.4 \pm 0.4 \pm 0.1$	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	

NODE=M162R01
NODE=M162R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From analysis of L3 data at 183–209 GeV.

NODE=M162R01;LINKAGE=SC

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$ Γ_6/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.029 ± 0.04	$^{+0.011}_{-0.012}$	¹ KOPF	21	RVUE	0.9 $p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$
4.134 ± 0.106	$^{+4.909}_{-2.988}$	² ALBRECHT	20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

² Residues from T-matrix pole, 2 poles, 2 channels ($\pi\eta, K\bar{K}$).

NODE=M162R00
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NODE=M162R00;LINKAGE=B

NODE=M162R00;LINKAGE=A

 $\Gamma(\eta'\pi)/\Gamma(\eta\pi)$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.035 ± 0.044	$^{+0.069}_{-0.012}$	¹ KOPF	21	RVUE	0.9 $p\bar{p} \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$ and 191 $\pi^- p \rightarrow$ $\pi^- \pi^- \pi^+ p$

¹ From T-matrix pole based on combined fit of Crystal Barrel and $\pi\pi$ scattering data (ALBRECHT 20), and COMPASS data (ADOLPH 15), using a coupled-channel model of $\eta\pi, \eta'\pi$ and $K\bar{K}$ systems.

NODE=M162R02
NODE=M162R02

NODE=M162R02;LINKAGE=A

 $a_2(1700)$ REFERENCES

KOPF	21	EPJ C81 1056	B. Kopf <i>et al.</i>	(BOCH)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
RODAS	19	PRL 122 042002	A. Rodas <i>et al.</i>	(JPAC Collab.)
AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
JACKURA	18	PL B779 464	A. Jackura <i>et al.</i>	(JPAC and COMPASS Collab.)
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
ABELE	99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
GRYGOREV	99	PAN 62 470	V.K. Grygorev <i>et al.</i>	
		Translated from YAF 62 513.		
ACCIARRI	97T	PL B413 147	M. Acciarri <i>et al.</i>	(L3 Collab.)

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REFID=45761

$a_0(1710)$

$$J^{PC} = 1^-(0^{++})$$

NODE=M263

OMITTED FROM SUMMARY TABLE

Evidence for this state is also inferred from the interference of the $K^+ K^-$ and $K_S^0 K_S^0$ decays of the $f_0(1710)$ in $D_s^+ \rightarrow f_0(1710) \pi^+$, leading to a relative branching ratio an order of magnitude larger than expected from isospin symmetry (ABLIKIM 22F). See also the review on "Spectroscopy of Light Meson Resonances."

NODE=M263

 $a_0(1710)$ MASS

NODE=M263M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1713±19 OUR AVERAGE	Error includes scale factor of 3.8. See the ideogram below. [1711 ± 27 MeV OUR 2023 AVERAGE Scale factor = 5.1]		
1736±10±12	¹ AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
1817± 8±20	² ABLIKIM	22AH BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
1704± 5± 2	LEES	21A BABR	$\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$

NODE=M263M

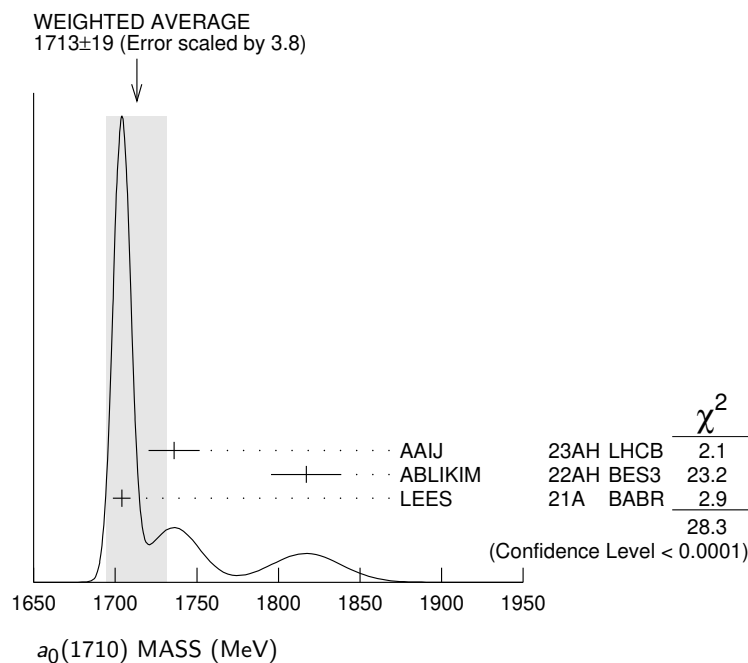
NEW

¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$

² Observed to decay into $K_S^0 K^+$ in a Breit-Wigner amplitude analysis involving D_s^+ decays into $\bar{K}^*(892)^0 K^+$, $\bar{K}^*(892)^+ K_S^0$, $\bar{K}^*(1410)^0 K^+$, $a_0(980)^+ \pi^0$, and $a_0(1817)^+ \pi^0$.

NODE=M263M;LINKAGE=B

NODE=M263M;LINKAGE=A

 **$a_0(1710)$ WIDTH**

NODE=M263W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
107±15 OUR AVERAGE	[106 ± 15 MeV OUR 2023 AVERAGE]		
134±17±61	¹ AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
97±22±15	² ABLIKIM	22AH BES3	$D_s^+ \rightarrow K_S^0 K^+ \pi^0$
110±15±11	LEES	21A BABR	$\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$

NODE=M263W

NEW

¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$

² Observed to decay into $K_S^0 K^+$ in a Breit-Wigner amplitude analysis involving D_s^+ decays into $\bar{K}^*(892)^0 K^+$, $\bar{K}^*(892)^+ K_S^0$, $\bar{K}^*(1410)^0 K^+$, $a_0(980)^+ \pi^0$, and $a_0(1817)^+ \pi^0$.

NODE=M263W;LINKAGE=B

NODE=M263W;LINKAGE=A

$a_0(1710)$ DECAY MODES

NODE=M263215;NODE=M263

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\eta$	seen
$\Gamma_2 \quad K^+ K^-$	seen
$\Gamma_3 \quad K_S^0 K_S^0$	seen
$\Gamma_4 \quad K_S^0 K^+$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←

$\Gamma(\pi\eta)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	LEES 21A BABR $\eta_c(1S) \rightarrow \pi^+ \pi^- \eta$

NODE=M263R01
NODE=M263R01

$\Gamma(K^+ K^-)/\Gamma(K_S^0 K_S^0)$	Γ_2/Γ_3
VALUE	DOCUMENT ID TECN COMMENT
0.32±0.12	¹ ABLIKIM 22F BES3 $D_s^+ \rightarrow K_S^0 K_S^0 \pi^+$

NODE=M263R00
NODE=M263R00
OCCUR=2

¹ Using $D_s^+ \rightarrow K^+ K^- \pi^+$ from ABLIKIM 21AE. The apparent violation of isospin symmetry may be due to a destructive interference with the $f_0(1710)$ in the $K^+ K^-$ channel, and a constructive interference in the $K_S^0 K_S^0$ channel.

NODE=M263R00;LINKAGE=B

$\Gamma(K_S^0 K^+)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ABLIKIM 22AH BES3 $D_s^+ \rightarrow K_S^0 K^+ \pi^0$

NODE=M263R02
NODE=M263R02

 $a_0(1710)$ REFERENCES

AAIJ	23AH PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	22AH PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22F PR D105 L051103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AE PR D104 012016	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	21A PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)

NODE=M263

REFID=62349
REFID=61880
REFID=61641
REFID=61367
REFID=61442

$f_0(1710)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M068

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M068

 $f_0(1710)$ T-MATRIX POLE $\sqrt{s}$

NODE=M068PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M068PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1680–1820) – i (50–180) OUR ESTIMATE			
$(1769 \pm 8) - i(78 \pm 6)$	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
$(1700 \pm 18) - i(127 \pm 12)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1803 \pm 3.5^{+45.5}_{-10.4}) - i(145 \pm 2.5^{+16.3}_{-9.6})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta\eta, \pi^0 K^+ K^-$
$(1732 \pm 15) - i(160^{+25}_{-10})$	³ ANISOVICH	03	RVUE $\pi\pi, K\bar{K}, \eta\eta, \eta\eta', \pi\pi\pi\pi$
$(1698 \pm 18) - i(60 \pm 13)$	BARBERIS	00E	OMEG 450 $p\bar{p} \rightarrow p_f \eta\eta p_S$
$(1770 \pm 12) - i(110 \pm 20)$	⁴ ANISOVICH	99B	SPEC 0.6–1.2 $p\bar{p} \rightarrow \eta\eta\pi^0$
$(1727 \pm 12 \pm 11) - i(63 \pm 8 \pm 9)$	BARBERIS	99D	OMEG 450 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$
$(1750 \pm 30) - i(125 \pm 70)$	ANISOVICH	98B	RVUE Compilation

NODE=M068PP

→ UNCHECKED ←

OCCUR=3

¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).

NODE=M068PP;LINKAGE=O

² T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$), and BINON 84C ($\eta\eta'$).

NODE=M068PP;LINKAGE=H

³ Solution I.

NODE=M068PP;LINKAGE=A

⁴ Not seen by AMSLER 02.

NODE=M068PP;LINKAGE=AV

$f_0(1710)$ Breit-Wigner MASS

NODE=M068M

NODE=M068M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1733 \pm \frac{8}{7}$	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
1757 ± 24	± 9	LEES	21A	BABR $\eta_c(1S) \rightarrow \eta' K^+ K^-$
1759 ± 6	$^{+14}_{-25}$	5.5k	1	ABLIKIM 13N BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
$1750 \pm \frac{6}{7}$	$^{+29}_{-18}$	2	UEHARA 13	BELL $\gamma \gamma \rightarrow K_S^0 K_S^0$
1701 ± 5	$^{+9}_{-2}$	4k	3	CHEKANOV 08 ZEUS $e p \rightarrow K_S^0 K_S^0 X$
$1765 \pm \frac{4}{3}$	± 13	ABLIKIM	06V	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
1738 ± 30		ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
1740 ± 4	$^{+10}_{-25}$	BAI	03G	BES $J/\psi \rightarrow \gamma K \bar{K}$
$1740 \pm \frac{30}{25}$		BAI	00A	BES $J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
1710 ± 25		4	FRENCH 99	300 $p p \rightarrow p_f (K^+ K^-) p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1744 ± 7	± 5	381	5,6	DOBBS 15 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
1705 ± 11	± 5	237	5,6	DOBBS 15 $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
1706 ± 4	± 5	1.0k	5,6	DOBBS 15 $J/\psi \rightarrow \gamma K^+ K^-$
1690 ± 8	± 3	349	5,6	DOBBS 15 $\psi(2S) \rightarrow \gamma K^+ K^-$
1750 ± 13		AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$
1747 ± 5	80k	7	UMAN 06	E835 5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
1776 ± 15		VLADIMIRSK...	06	SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1670 ± 20		BINON	05	GAMS 33 $\pi^- p \rightarrow \eta \eta n$
1682 ± 16		TIKHOMIROV	03	SPEC 40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1670 ± 26	3.6k	8	NICHITIU 02	OBLX 0 $\bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1730 ± 15		BARBERIS	99	OMEG 450 $p p \rightarrow p_s p_f K^+ K^-$
1750 ± 20		BARBERIS	99B	OMEG 450 $p p \rightarrow p_s p_f \pi^+ \pi^-$
1720 ± 39		BAI	98H	BES $J/\psi \rightarrow \gamma \pi^0 \pi^0$
1775 ± 1.5	57	9	BARKOV 98	$\pi^- p \rightarrow K_S^0 K_S^0 n$
1690 ± 11		10	ABREU 96C	DLPH $Z^0 \rightarrow K^+ K^- + X$
1696 ± 5	$^{+9}_{-34}$	11	BAI 96C	BES $J/\psi \rightarrow \gamma K^+ K^-$
1781 ± 8	$^{+10}_{-31}$	BAI	96C	BES $J/\psi \rightarrow \gamma K^+ K^-$
1768 ± 14		BALOSHIN	95	SPEC 40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
1750 ± 15		12	BUGG 95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1620 ± 16		11	BUGG 95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
1748 ± 10		13	ARMSTRONG 93C	E760 $\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
~ 1750		BREAKSTONE	93	SFM $p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$
1744 ± 15		14	ALDE 92D	GAM2 38 $\pi^- p \rightarrow \eta \eta n$
1713 ± 10		15	ARMSTRONG 89D	OMEG 300 $p p \rightarrow p p K^+ K^-$
1706 ± 10		15	ARMSTRONG 89D	OMEG 300 $p p \rightarrow p p K_S^0 K_S^0$
1707 ± 10		13	AUGUSTIN 88	DM2 $J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$
1700 ± 15		11	BOLONKIN 88	SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1720 ± 60		BOLONKIN	88	SPEC 40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1638 ± 10		16	FALVARD 88	DM2 $J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
1690 ± 4		17	FALVARD 88	DM2 $J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$
1698 ± 15		13	AUGUSTIN 87	DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
1720 ± 10	± 10	11	BALTRUSAIT..	87 MRK3 $J/\psi \rightarrow \gamma K^+ K^-$
1755 ± 8		18	ALDE 86C	GAM2 38 $\pi^- p \rightarrow n 2\eta$
$1730 \pm \frac{2}{10}$		19	LONGACRE 86	RVUE 22 $\pi^- p \rightarrow n 2 K_S^0$
1742 ± 15		13	WILLIAMS 84	MPSF 200 $\pi^- N \rightarrow 2 K_S^0 X$
1670 ± 50		BLOOM	83	CBAL $J/\psi \rightarrow \gamma 2\eta$
1650 ± 50		BURKE	82	MRK2 $J/\psi \rightarrow \gamma 2\rho$
1640 ± 50		20,21	EDWARDS 82D	CBAL $J/\psi \rightarrow \gamma 2\eta$
1730 ± 10	± 20	22	ETKIN 82C	MPS 23 $\pi^- p \rightarrow n 2 K_S^0$

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
- ² Spin 0 favored over spin 2.
- ³ In the SU(3) based model with a specific interference pattern of the $f_2(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.
- ⁴ $J^P = 0^+$, supersedes ARMSTRONG 89D.
- ⁵ Using CLEO-c data but not authored by the CLEO Collaboration.
- ⁶ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 135$ MeV.
- ⁷ Systematic errors not estimated.
- ⁸ Decaying to $f_0(1370)\pi\pi$.
- ⁹ No J^{PC} determination.
- ¹⁰ No J^{PC} determination, width not determined.
- ¹¹ $J^P = 2^+$.
- ¹² From a fit to the 0^+ partial wave.
- ¹³ No J^{PC} determination.
- ¹⁴ ALDE 92D combines all the GAMS-2000 data.
- ¹⁵ $J^P = 2^+$, superseded by FRENCH 99.
- ¹⁶ From an analysis ignoring interference with $f_2'(1525)$.
- ¹⁷ From an analysis including interference with $f_2'(1525)$.
- ¹⁸ Superseded by ALDE 92D.
- ¹⁹ Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.
- ²⁰ $J^P = 2^+$ preferred.
- ²¹ From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.
- ²² Superseded by LONGACRE 86.

NODE=M068M;LINKAGE=D

NODE=M068M;LINKAGE=H

NODE=M068M;LINKAGE=HE

NODE=M068M;LINKAGE=C3

NODE=M068M;LINKAGE=F

NODE=M068M;LINKAGE=G

NODE=M068M;LINKAGE=CH

NODE=M068M;LINKAGE=NC

NODE=M068M;LINKAGE=4A

NODE=M068M;LINKAGE=A4

NODE=M068M;LINKAGE=A3

NODE=M068M;LINKAGE=Q0

NODE=M068M;LINKAGE=A1

NODE=M068M;LINKAGE=AA

NODE=M068M;LINKAGE=C

NODE=M068M;LINKAGE=A

NODE=M068M;LINKAGE=B

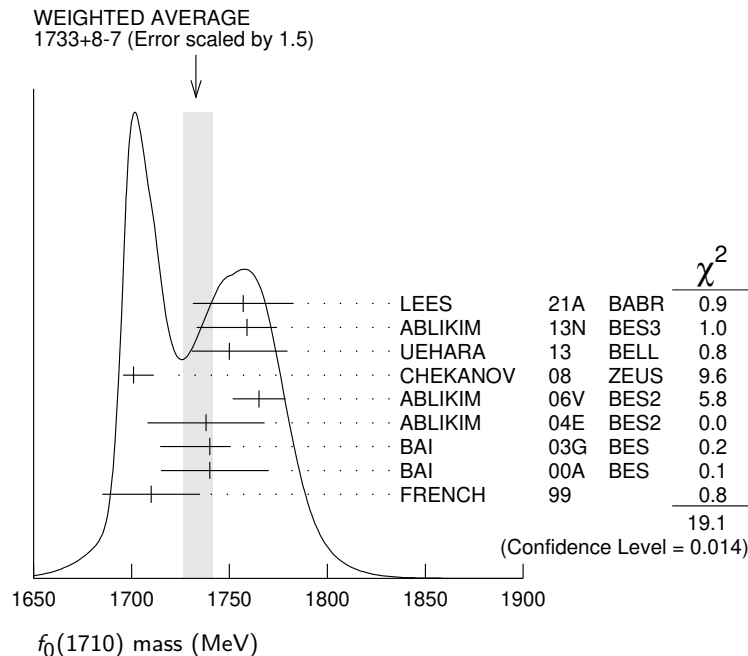
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NODE=M068M;LINKAGE=A9

NODE=M068M;LINKAGE=B2

NODE=M068M;LINKAGE=E

NODE=M068M;LINKAGE=B1



$f_0(1710)$ Breit-Wigner WIDTH

NODE=M068W

NODE=M068W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
150 $\pm$ 12 $\pm$ 10	OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
175 $\pm$ 23 $\pm$ 4		LEES	21A BABR	$\eta_c(1S) \rightarrow \eta' K^+ K^-$
172 $\pm$ 10 $\pm$ 32 $\pm$ 16	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
139 $\pm$ 11 $\pm$ 96 $\pm$ 12 $\pm$ 50		² UEHARA	13 BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
100 $\pm$ 24 $\pm$ 7 $\pm$ 22	4k	³ CHEKANOV	08 ZEUS	$ep \rightarrow K_S^0 K_S^0 X$
145 $\pm$ 8 $\pm$ 69		ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
125 $\pm$ 20		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
166 $\pm$ 5 $\pm$ 15 $\pm$ 8 $\pm$ 10		BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
120 $\pm$ 50 $\pm$ 40		BAI	00A BES	$J/\psi \rightarrow \gamma (\pi^+ \pi^- \pi^+ \pi^-)$
105 $\pm$ 34		⁴ FRENCH	99	300 $pp \rightarrow p_f(K^+ K^-) p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

148	± 40 -30		AMSLER	06	CBAR	1.64	$\bar{p}p \rightarrow K^+ K^- \pi^0$	
188	± 13	80k	⁵ UMAN	06	E835	5.2	$\bar{p}p \rightarrow \eta \eta \pi^0$	
250	± 30		VLADIMIRSK...	06	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
260	± 50		BINON	05	GAMS	33	$\pi^- p \rightarrow \eta \eta n$	
102	± 26		TIKHOMIROV	03	SPEC	40.0	$\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
267	± 44	3651	⁶ NICHITIU	02	OBLX	0	$\bar{p}p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	
100	± 25		BARBERIS	99	OMEG	450	$pp \rightarrow p_s p_f K^+ K^-$	
160	± 30		BARBERIS	99B	OMEG	450	$pp \rightarrow p_s p_f \pi^+ \pi^-$	
30	± 7	57	⁷ BARKOV	98			$\pi^- p \rightarrow K_S^0 K_S^0 n$	
103	± 18	$\begin{smallmatrix} +30 \\ -11 \end{smallmatrix}$	⁸ BAI	96C	BES		$J/\psi \rightarrow \gamma K^+ K^-$	
85	± 24	$\begin{smallmatrix} +22 \\ -19 \end{smallmatrix}$	BAI	96C	BES		$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2
56	± 19		BALOSHIN	95	SPEC	40	$\pi^- C \rightarrow K_S^0 K_S^0 X$	
160	± 40		⁹ BUGG	95	MRK3		$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	
160	$\begin{smallmatrix} +60 \\ -20 \end{smallmatrix}$		⁸ BUGG	95	MRK3		$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	OCCUR=2
264	± 25		¹⁰ ARMSTRONG	93C	E760		$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
200	to 300		BREAKSTONE	93	SFM		$pp \rightarrow pp \pi^+ \pi^- \pi^+ \pi^-$	
< 80	90% CL		¹¹ ALDE	92D	GAM2	38	$\pi^- p \rightarrow \eta \eta N^*$	
181	± 30		¹² ARMSTRONG	89D	OMEG	300	$pp \rightarrow pp K^+ K^-$	
104	± 30		¹² ARMSTRONG	89D	OMEG	300	$pp \rightarrow pp K_S^0 K_S^0$	OCCUR=2
166.4	± 33.2		¹⁰ AUGUSTIN	88	DM2		$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$	
30	± 20		⁸ BOLONKIN	88	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
350	± 150		BOLONKIN	88	SPEC	40	$\pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
148	± 17		¹³ FALVARD	88	DM2		$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
184	± 6		¹⁴ FALVARD	88	DM2		$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
136	± 28		¹⁰ AUGUSTIN	87	DM2		$J/\psi \rightarrow \gamma \pi^+ \pi^-$	
130	± 20		⁸ BALTRUSAIT...	87	MRK3		$J/\psi \rightarrow \gamma K^+ K^-$	
122	$\begin{smallmatrix} +74 \\ -15 \end{smallmatrix}$		¹⁵ LONGACRE	86	RVUE	22	$\pi^- p \rightarrow n 2K_S^0$	
57	± 38		¹⁶ WILLIAMS	84	MPSF	200	$\pi^- N \rightarrow 2K_S^0 X$	
160	± 80		BLOOM	83	CBAL		$J/\psi \rightarrow \gamma 2\eta$	
200	± 100		BURKE	82	MRK2		$J/\psi \rightarrow \gamma 2\rho$	
220	$\begin{smallmatrix} +100 \\ -70 \end{smallmatrix}$		^{17,18} EDWARDS	82D	CBAL		$J/\psi \rightarrow \gamma 2\eta$	
200	$\begin{smallmatrix} +156 \\ -9 \end{smallmatrix}$		¹⁹ ETKIN	82B	MPS	23	$\pi^- p \rightarrow n 2K_S^0$	

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Spin 0 favored over spin 2.

³ In the SU(3) based model with a specific interference pattern of the $f_2'(1270)$, $a_2^0(1320)$, and $f_2'(1525)$ mesons incoherently added to the $f_0(1710)$ and non-resonant background.

⁴ $J^P = 0^+$, supersedes ARMSTRONG 89D.

⁵ Systematic errors not estimated.

⁶ Decaying to $f_0(1370)\pi\pi$.

⁷ No J^{PC} determination.

⁸ $J^P = 2^+$.

⁹ From a fit to the 0^+ partial wave.

¹⁰ No J^{PC} determination.

¹¹ ALDE 92D combines all the GAMS-2000 data.

¹² $J^P = 2^+$, (0^+ excluded).

¹³ From an analysis ignoring interference with $f_2'(1525)$.

¹⁴ From an analysis including interference with $f_2'(1525)$.

¹⁵ Uses MRK3 data. From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

¹⁶ No J^{PC} determination.

¹⁷ $J^P = 2^+$ preferred.

¹⁸ From fit neglecting nearby $f_2'(1525)$. Replaced by BLOOM 83.

¹⁹ From an amplitude analysis of the $K_S^0 K_S^0$ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=F

NODE=M068W;LINKAGE=G

NODE=M068W;LINKAGE=HE

NODE=M068W;LINKAGE=C3

NODE=M068W;LINKAGE=CH

NODE=M068W;LINKAGE=NC

NODE=M068W;LINKAGE=4A

NODE=M068W;LINKAGE=A3

NODE=M068W;LINKAGE=Q0

NODE=M068W;LINKAGE=A1

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NODE=M068W;LINKAGE=C

NODE=M068W;LINKAGE=D

NODE=M068W;LINKAGE=A9

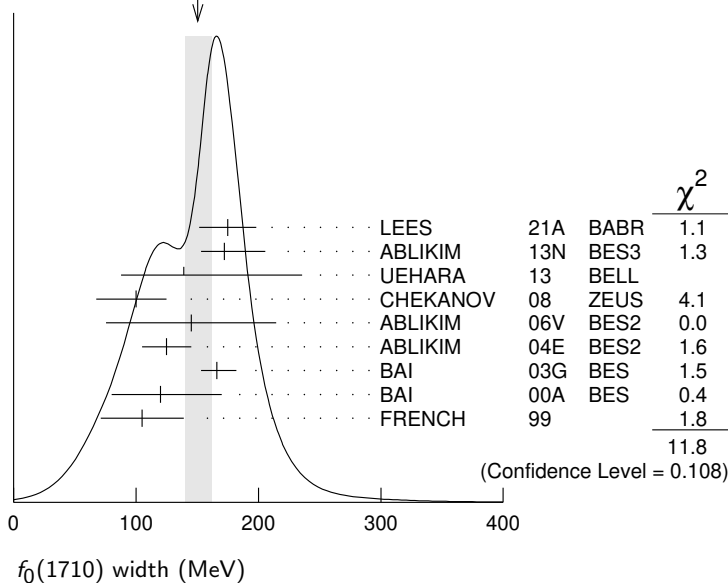
NODE=M068M;LINKAGE=WI

NODE=M068W;LINKAGE=B2

NODE=M068W;LINKAGE=E

NODE=M068W;LINKAGE=A

WEIGHTED AVERAGE
150+12-10 (Error scaled by 1.3)



$f_0(1710)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}$	seen
Γ_2 $\eta\eta$	seen
Γ_3 $\eta\eta'$	not seen
Γ_4 $\pi\pi$	seen
Γ_5 $\gamma\gamma$	seen
Γ_6 $\omega\omega$	seen

NODE=M068215;NODE=M068

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=4

$f_0(1710)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_5/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
$12^{+3}_{-2} + 227_8$		UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<480	95	ALBRECHT	90G	ARG	$\gamma\gamma \rightarrow K^+ K^-$
<110	95	¹ BEHREND	89C	CELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
<280	95	¹ ALTHOFF	85B	TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ Assuming helicity 2.

NODE=M068220

NODE=M068G2
NODE=M068G2

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_5/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.82	95	¹ BARATE	00E	ALEP	$\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ Assuming spin 0.

NODE=M068G2;LINKAGE=F

NODE=M068G3
NODE=M068G3

NODE=M068G;LINKAGE=Z

$f_0(1710)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVS	DOCUMENT ID	TECN	COMMENT	
seen	1004	¹ DOBBS	15		$J/\psi \rightarrow \gamma K^+ K^-$
seen	349	¹ DOBBS	15		$\psi(2S) \rightarrow \gamma K^+ K^-$
0.36 ± 0.12		ALBALADEJO	08	RVUE	
$0.38^{+0.09}_{-0.19}$		² LONGACRE	86	MPS	$22 \pi^- p \rightarrow n 2 K_S^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068225

NODE=M068R2
NODE=M068R2

OCCUR=2

NODE=M068R2;LINKAGE=A
NODE=M068R;LINKAGE=L

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.22 ± 0.12	ALBALADEJO 08	RVUE

$0.18^{+0.03}_{-0.13}$	¹ LONGACRE 86	RVUE

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

 Γ_2/Γ

NODE=M068R1
NODE=M068R1

NODE=M068R1;LINKAGE=L

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.48 ± 0.15		BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.46^{+0.70}_{-0.38}$		¹ ANISOVICH	02D	SPEC Combined fit

< 0.02	90	² PROKOSHKIN 91	GA24	300 $\pi^- p \rightarrow \pi^- p \eta \eta$

¹ From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

² Combining results of GAM4 with those of ARMSTRONG 89D.

 Γ_2/Γ_1

NODE=M068R7
NODE=M068R7

NODE=M068R7;LINKAGE=CH

NODE=M068R;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	381	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

seen	237	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

not seen		AMSLER	02	CBAR $0.9 \bar{p} p \rightarrow \pi^0 \eta \eta$, $\pi^0 \pi^0 \pi^0$

$0.039^{+0.002}_{-0.024}$		² LONGACRE	86	RVUE

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

 Γ_4/Γ

NODE=M068R5
NODE=M068R5

OCCUR=2

NODE=M068R5;LINKAGE=A

NODE=M068R5;LINKAGE=L

 $\Gamma(\pi\pi)/\Gamma(K\bar{K})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

0.23 ± 0.05	OUR AVERAGE	Error includes scale factor of 1.2.		

$0.64 \pm 0.27 \pm 0.18$		LEES	18A	BABR $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$, $\gamma K^+ K^-$

$0.41^{+0.11}_{-0.17}$		ABLIKIM	06V	BES2 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

$0.2 \pm 0.024 \pm 0.036$		BARBERIS	99D	OMEG 450 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

0.39 ± 0.14		ARMSTRONG 91	OMEG 300	$p\bar{p} \rightarrow p p \pi \pi$, $p p K \bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.32 ± 0.14		ALBALADEJO 08	RVUE	

< 0.11	95	¹ ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$

$5.8^{+9.1}_{-5.5}$		² ANISOVICH	02D	SPEC Combined fit

¹ Using data from ABLIKIM 04A.

² From a combined K-matrix analysis of Crystal Barrel (0. $p\bar{p} \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$), GAMS ($\pi p \rightarrow \pi^0 \pi^0 n$, $\eta \eta n$, $\eta \eta' n$), and BNL ($\pi p \rightarrow K\bar{K} n$) data.

 Γ_4/Γ_1

NODE=M068R6
NODE=M068R6

NODE=M068R;LINKAGE=AB

NODE=M068R;LINKAGE=CH

 $\Gamma(\eta\eta')/\Gamma(\pi\pi)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$< 2.87 \times 10^{-3}$	90	¹ ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma \eta \eta'$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

 Γ_3/Γ_4

NODE=M068R00
NODE=M068R00

NODE=M068R00;LINKAGE=A

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

seen	180	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma \omega \omega$

 Γ_6/Γ

NODE=M068R3
NODE=M068R3

f₀(1710) REFERENCES

NODE=M068

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)	REFID=61610
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61442
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
LEES	18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58950
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ALBALADEJO	08	PRL 101 252002	M. Albaladejo, J.A. Oller		REFID=52656
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
AMSLER	06	PL B639 165	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
		Translated from YAF 69 515.			
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
		Translated from YAF 68 998.			
ABLIKIM	04A	PL B598 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49740
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50174
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
		Translated from YAF 66 860.			
AMSLER	02	EPJ C23 29	C. AMSler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48580
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
		Translated from YAF 65 1583.			
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47426
BARATE	00E	PL B472 189	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47428
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>		REFID=46886
BARBERIS	99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARBERIS	99B	PL B453 316	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46922
BARBERIS	99D	PL B462 462	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=47395
FRENCH	99	PL B460 213	B. French <i>et al.</i>	(WA76 Collab.)	REFID=47491
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BARKOV	98	JETPL 68 764	B.P. Barkov <i>et al.</i>		REFID=46616
ABREU	96C	PL B379 309	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BALOSHIN	95	PAN 58 46	O.N. Baloshin <i>et al.</i>	(ITEP)	REFID=44621
		Translated from YAF 58 50.			
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
BREAKSTONE	93	ZPHY C58 251	A.M. Breakstone <i>et al.</i>	(IOWA, CERN, DORT+)	REFID=43312
ALDE	92D	PL B284 457	D.M. Alde <i>et al.</i>	(GAM2 Collab.)	REFID=41591
Also		SJNP 54 451	D.M. Alde <i>et al.</i>	(GAM2 Collab.)	REFID=44696
		Translated from YAF 54 745.			
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
PROKOSHKIN	91	SPD 36 155	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
		Translated from DANS 316 900.			
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
ARMSTRONG	89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41010
BEHREND	89C	ZPHY C43 91	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)	REFID=40580
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86C	PL B182 105	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=21694
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BINON	84C	NC 80A 363	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=21418
WILLIAMS	84	PR D30 877	E.G.H. Williams <i>et al.</i>	(VAND, NDAM, TUFTS+)	REFID=21693
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=20750
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ETKIN	82C	PR D25 2446	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20391
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIIM)	REFID=20355

X(1750)

$$I^G(J^{PC}) = ?^-(1^{--})$$

NODE=M255

OMITTED FROM SUMMARY TABLE

The X(1750) was separated from the $\phi(1680)$ in the 2022 listings due to its incompatible mass and incompatible pattern of $\bar{K}K$ and $\bar{K}^*(892)K$ branching fractions.

NODE=M255

X(1750) MASS

NODE=M255M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1753.8 ± 2.7 OUR AVERAGE			
1784 ± 12 $^{+0}_{-27}$	ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1753.5 ± 1.5 ± 2.3	LINK	02K FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1726 ± 22	BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
1760 ± 20	ATKINSON	85C OMEG	20–70 $\gamma p \rightarrow K \bar{K} X$
1690 ± 10	ASTON	81F OMEG	25–70 $\gamma p \rightarrow K^+ K^- X$

NODE=M255M

X(1750) WIDTH

NODE=M255W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
120 ± 10 OUR AVERAGE			
106 $^{+22}_{-19}$ $^{+8}_{-36}$	ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
122.2 ± 6.2 ± 8.0	LINK	02K FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
121 ± 47	BUSENITZ	89 TPS	$\gamma p \rightarrow K^+ K^- X$
80 ± 40	ATKINSON	85C OMEG	20–70 $\gamma p \rightarrow K \bar{K} X$
100 ± 40	ASTON	81F OMEG	25–70 $\gamma p \rightarrow K^+ K^- X$

NODE=M255W

X(1750) DECAY MODES

NODE=M255215;NODE=M255

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^+ K^-$	seen
Γ_2 $\bar{K}^*(892)^0 K_S^0$	not seen
Γ_3 $K^*(892)^\pm K^\mp$	not seen
Γ_4 $\eta \phi$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4

$$\Gamma(\bar{K}^*(892)^0 K_S^0)/\Gamma(K^+ K^-)$$

 Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.065	90	LINK	02K FOCS	$\gamma p \rightarrow K^+ K^- p$

NODE=M255R01
 NODE=M255R01

$$\Gamma(K^*(892)^\pm K^\mp)/\Gamma(K^+ K^-)$$

 Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.183	90	LINK	02K FOCS	$\gamma p \rightarrow K^+ K^- p$

NODE=M255R02
 NODE=M255R02

$$\Gamma(\eta \phi)/\Gamma_{\text{total}}$$

 Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ZHU	23A RVUE	$e^+ e^- \rightarrow \eta \phi$

NODE=M255R00
 NODE=M255R00

¹ Reported with a 2 σ significance in the fit and an upper limit of $\Gamma(e^+ e^-) B(X(1750) \rightarrow \eta \phi)$ in the range 136–322 eV.

NODE=M255R00;LINKAGE=A

X(1750) REFERENCES

NODE=M255

ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BUSENITZ	89	PR D40 1	J.K. Busenitz <i>et al.</i>	(ILL, FNAL)
ATKINSON	85C	ZPHY C27 233	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)

REFID=62439
 REFID=60256
 REFID=48845
 REFID=40927
 REFID=21596
 REFID=21585

$\eta(1760)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

NODE=M114

OMITTED FROM SUMMARY TABLE

Seen by DM2 in the $\rho\rho$ system (BISELLO 89B). Structure in this region has been reported before in the same system (BALTRUSAITIS 86B) and in the $\omega\omega$ system (BALTRUSAITIS 85C, BISELLO 87).

NODE=M114

 $\eta(1760)$ MASS

NODE=M114M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1751±15 OUR AVERAGE				
$1768^{+24}_{-25} \pm 10$	465	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
$1744 \pm 10 \pm 15$	1045	² ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1703^{+12}_{-11} \pm 2$		³ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
1760 ± 11	320	⁴ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114M

OCCUR=2

¹ From a single-resonance fit.² From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.³ From a two-resonance fit.⁴ Estimated by us from various fits. Systematic uncertainties not estimated.

NODE=M114M;LINKAGE=ZA

NODE=M114M;LINKAGE=MA

NODE=M114M;LINKAGE=ZH

NODE=M114M;LINKAGE=A

 $\eta(1760)$ WIDTH

NODE=M114W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
240±30 OUR AVERAGE				
$224^{+62}_{-56} \pm 25$	465	⁵ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
$244^{+24}_{-21} \pm 25$	1045	⁶ ABLIKIM	06H BES	$J/\psi \rightarrow \gamma\omega\omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$42^{+36}_{-22} \pm 15$		⁷ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
60 ± 16	320	⁸ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$

NODE=M114W

OCCUR=2

⁵ From a single-resonance fit.⁶ From a partial wave analysis including $\eta(1760)$, $f_0(1710)$, $f_2(1640)$, and $f_2(1910)$.⁷ From a two-resonance fit.⁸ Estimated by us from various fits. Systematic uncertainties not estimated.

NODE=M114W;LINKAGE=ZA

NODE=M114W;LINKAGE=MA

NODE=M114W;LINKAGE=ZH

NODE=M114W;LINKAGE=B

 $\eta(1760)$ DECAY MODES

NODE=M114215;NODE=M114

Mode	Fraction (Γ_i/Γ)
Γ_1 4π	
Γ_2 $2\pi^+2\pi^-$	seen
Γ_3 $\pi^+\pi^-2\pi^0$	seen
Γ_4 $\rho^0\rho^0$	seen
Γ_5 $\rho^+\rho^-$	seen
Γ_6 $\omega\omega$	seen
Γ_7 $\eta'\pi^+\pi^-$	seen
Γ_8 $\gamma\gamma$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=7

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

 $\eta(1760)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M114225

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_7\Gamma_8/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$28.2^{+7.9}_{-7.5} \pm 3.7$	465	⁹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.0^{+2.0}_{-1.2} \pm 0.8$	52	¹⁰ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	
$18^{+13}_{-10} \pm 5$	315	¹¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$	

NODE=M114G01

NODE=M114G01

OCCUR=2

OCCUR=3

⁹ From a single-resonance fit.¹⁰ From a two-resonance fit. For constructive interference with the X(1835).¹¹ From a two-resonance fit. For destructive interference with the X(1835).

NODE=M114G01;LINKAGE=ZH

NODE=M114G01;LINKAGE=ZA

NODE=M114G01;LINKAGE=ZN

$\eta(1760)$ BRANCHING RATIOS

NODE=M114210

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BISELLO

89B

DM2

 $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$ NODE=M114R01
NODE=M114R01 $\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BISELLO

89B

DM2

 $J/\psi \rightarrow \gamma \pi^+ \pi^- 2\pi^0$ NODE=M114R02
NODE=M114R02 $\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BISELLO

89B

DM2

 $J/\psi \rightarrow \gamma \rho^0 \rho^0$

seen

BALTRUSAIT...86

MRK3

 $J/\psi \rightarrow \gamma \rho^0 \rho^0$ NODE=M114R03
NODE=M114R03 $\Gamma(\rho^+ \rho^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BISELLO

89B

DM2

 $J/\psi \rightarrow \gamma \rho^+ \rho^-$

seen

BALTRUSAIT...86

MRK3

 $J/\psi \rightarrow \gamma \rho^+ \rho^-$ NODE=M114R04
NODE=M114R04 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

seen

BISELLO

87

DM2

 $J/\psi \rightarrow \omega\omega$

seen

BALTRUSAIT...85C

MRK3

 $J/\psi \rightarrow \gamma\omega\omega$ NODE=M114R06
NODE=M114R06 $\Gamma(\gamma\gamma)/\Gamma(\omega\omega)$ Γ_8/Γ_6

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

 $<2.48 \times 10^{-3}$

90

12

ABLIKIM

180

BES3

 $\psi(2S) \rightarrow \pi^+ \pi^- \gamma\gamma\gamma$ NODE=M114R08
NODE=M114R08¹² Using results from ABLIKIM 06H.

NODE=M114R08;LINKAGE=A

 $\eta(1760)$ REFERENCES

NODE=M114

ABLIKIM	180	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)
BALTRUSAIT... 86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	
BALTRUSAIT... 86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	
BALTRUSAIT... 85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	

NODE=M264

 $f_0(1770)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M264

 $f_0(1770)$ Breit-Wigner MASS

NODE=M264M

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M264M

 1784^{+16}_{-14} OUR AVERAGE Error includes scale factor of 1.1.1814 $\pm$ 31 7.2k ¹ KHOLODENK..21 VES 29 $\pi^- p \rightarrow n\omega\phi$ 1795 $\pm$ 7 $^{+23}_{-20}$ ABLIKIM 13J BES3 $J/\psi \rightarrow \gamma\omega\phi$ 1760 $\pm$ 15 $^{+15}_{-10}$ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma\pi^+ \pi^- K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1765 $\pm$ 15 SARANTSEV 21 RVUE $J/\psi \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ 1814 $\pm$ 18 ^{2,3} AAIJ 14BR LHCB $\bar{B}_s^0 \rightarrow J/\psi\pi^+\pi^-$ 1812 $^{+19}_{-26} \pm 18$ ⁴ ABLIKIM 06J BES2 $J/\psi \rightarrow \gamma\omega\phi$ 1790 $^{+40}_{-30}$ ABLIKIM 05 BES2 $J/\psi \rightarrow \phi\pi^+\pi^-$

¹ From partial wave analysis of $\omega\phi$ invariant mass including 0^{++} , 2^{++} , and 0^{-+} resonances.
² Second solution: 1800 ± 22 MeV. The fit favors $f_0(1770)$ to $f_0(1710)$.
³ Statistical error only.
⁴ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm \omega\phi$.

NODE=M264M;LINKAGE=M

NODE=M264M;LINKAGE=A
NODE=M264M;LINKAGE=B
NODE=M264M;LINKAGE=L

NODE=M264W

NODE=M264W

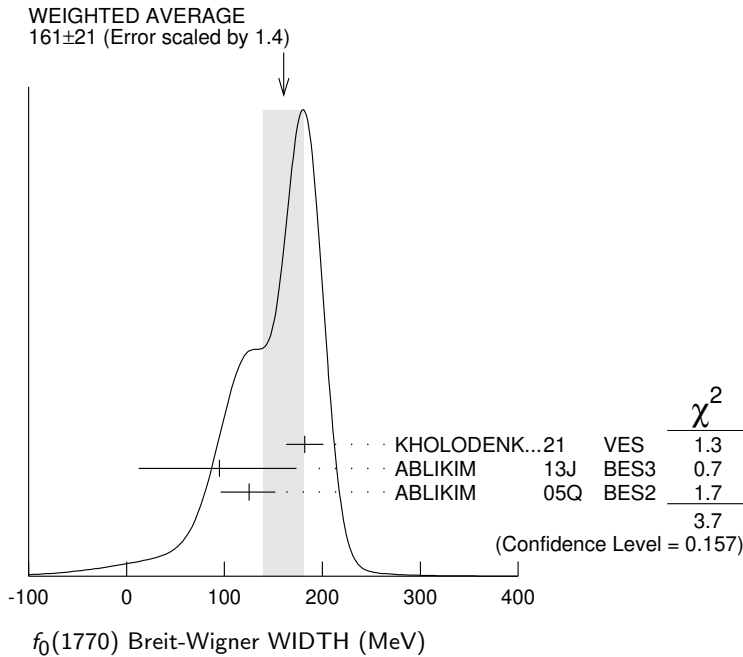
$f_0(1770)$ Breit-Wigner WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
161±21 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
182±19	7.2k	¹ KHOLODENK..21	VES	29 $\pi^- p \rightarrow n \omega\phi$
95±10 ⁺⁷⁸ ₋₈₂		ABLIKIM	13J BES3	$J/\psi \rightarrow \gamma \omega\phi$
125±25 ⁺¹⁰ ₋₁₅		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
180±20		SARANTSEV	21 RVUE	$J/\psi \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
328±34		^{2,3} AAIJ	14BR LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$
105±20±28		⁴ ABLIKIM	06J BES2	$J/\psi \rightarrow \gamma \omega\phi$
270 ⁺⁶⁰ ₋₃₀		⁵ ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$

¹ From partial wave analysis of $\omega\phi$ invariant mass including 0^{++} , 2^{++} , and 0^{-+} resonances.
² Second solution: 263 ± 30 MeV. The fit favors $f_0(1770)$ to $f_0(1710)$.
³ Statistical error only.
⁴ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm \omega\phi$.
⁵ $f_0(1710)$ width fixed to PDG value.

NODE=M264W;LINKAGE=J

NODE=M264W;LINKAGE=A
NODE=M264W;LINKAGE=B
NODE=M264W;LINKAGE=I
NODE=M264W;LINKAGE=AB



$f_0(1770)$ DECAY MODES

NODE=M264215;NODE=M264

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\eta\eta$	seen
Γ_4 $\omega\phi$	seen

DESIG=1
DESIG=2
DESIG=3
DESIG=4

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	SARANTSEV	21 RVUE	$J/\psi \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$	
seen	AAIJ	14BR LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$	
seen	ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$	

NODE=M264R01
NODE=M264R01

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 Γ_2/Γ

NODE=M264R02
 NODE=M264R02

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 Γ_3/Γ

NODE=M264R03
 NODE=M264R03

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	7.2k	KHOLODENK..21	VES	$29 \pi^- p \rightarrow n\omega\phi$
seen		SARANTSEV 21	RVUE	$J/\psi \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 Γ_4/Γ

NODE=M264R04
 NODE=M264R04

 $f_0(1770)$ REFERENCES

KHOLODENK...21	PAN 83 1602	M.S. Kholodenko	(VES Collab.)
SARANTSEV 21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
AAIJ 14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM 13J	PR D87 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU 09	PR D79 071102	C. Liu <i>et al.</i>	(BELLE Collab.)
ABLIKIM 06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM 05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM 05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)

NODE=M264

REFID=61410
 REFID=61091
 REFID=56035
 REFID=54955
 REFID=52752
 REFID=51127
 REFID=50450
 REFID=50958

 $\pi(1800)$

$$I^G(J^{PC}) = 1^-(0^-+)$$

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M075

NODE=M075

 $\pi(1800)$ MASS

NODE=M075M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M075M

1810^{+9}_{-11} OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

1804^{+6}_{-9}	46M	¹ AGHASYAN	18B	COMP	$190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$1876 \pm 18 \pm 16$	4k	² EUGENIO	08	B852	$18 \pi^- p \rightarrow \eta\eta\pi^- p$
$1774 \pm 18 \pm 20$		³ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$1863 \pm 9 \pm 10$		⁴ CHUNG	02	B852	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$1840 \pm 10 \pm 10$	1.2k	AMELIN	96B	VES	$37 \pi^- A \rightarrow \eta\eta\pi^- A$
$1775 \pm 7 \pm 10$		⁵ AMELIN	95B	VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
1790 ± 14		⁶ BERDNIKOV	94	VES	$37 \pi^- A \rightarrow K^+ K^- \pi^- A$
$1873 \pm 33 \pm 20$		BELADIDZE	92C	VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
$1814 \pm 10 \pm 23$	426	BITYUKOV	91	VES	$36 \pi^- C \rightarrow \pi^- \eta \eta C$
1770 ± 30	1.1k	BELLINI	82	SPEC	$40 \pi^- A \rightarrow 3\pi A$

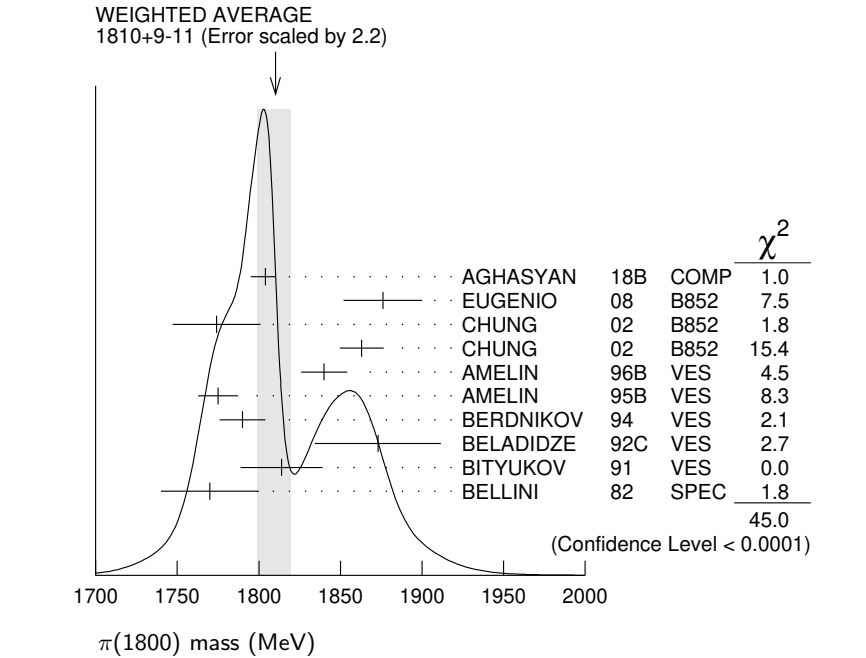
OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1785 \pm 9^{+12}_{-6}$	420k	⁷ ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$1737 \pm 5 \pm 15$		AMELIN	99	VES	$37 \pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

¹ Statistical error negligible.² From a single-pole fit.³ In the $f_0(980)\pi$ wave.⁴ In the $f_0(500)\pi$ wave.⁵ From a fit to $J^{PC} = 0^-+ f_0(980)\pi, f_0(1370)\pi$ waves.⁶ From a fit to $J^{PC} = 0^-+ K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves.⁷ Superseded by AGHASYAN 2018B.

NODE=M075M;LINKAGE=B
 NODE=M075M;LINKAGE=SP
 NODE=M075M;LINKAGE=C1
 NODE=M075M;LINKAGE=C2
 NODE=M075M;LINKAGE=AX
 NODE=M075M;LINKAGE=A
 NODE=M075M;LINKAGE=C



$\pi(1800)$ WIDTH

NODE=M075W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
215⁺⁷₋₈ OUR AVERAGE					
220 ⁺⁸ ₋₁₁	46M	⁸ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
221 $\pm$ 26 $\pm$ 38	4k	⁹ EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta \eta \pi^- p$
223 $\pm$ 48 $\pm$ 50		¹⁰ CHUNG	02	B852	18.3 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^- p$
191 $\pm$ 21 $\pm$ 20		¹¹ CHUNG	02	B852	18.3 $\pi^- p \rightarrow$ $\pi^+ \pi^- \pi^- p$
210 $\pm$ 30 $\pm$ 30	1.2k	AMELIN	96B	VES	37 $\pi^- A \rightarrow \eta \eta \pi^- A$
190 $\pm$ 15 $\pm$ 15		¹² AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
210 $\pm$ 70		¹³ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
225 $\pm$ 35 $\pm$ 20		BELADIDZE	92C	VES	36 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$
205 $\pm$ 18 $\pm$ 32	426	BITYUKOV	91	VES	36 $\pi^- \text{C} \rightarrow \pi^- \eta \eta \text{C}$
310 $\pm$ 50	1.1k	BELLINI	82	SPEC	40 $\pi^- A \rightarrow 3\pi A$

NODE=M075W

OCCUR=2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●

208 $\pm$ 22 ⁺²¹ ₋₃₇	420k	¹⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow$ $\pi^- \pi^- \pi^+ Pb'$
259 $\pm$ 19 $\pm$ 6		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

- ⁸Statistical error negligible.
- ⁹From a single-pole fit.
- ¹⁰In the $f_0(980)\pi$ wave.
- ¹¹In the $f_0(500)\pi$ wave.
- ¹²From a fit to $J^{PC} = 0^{-+} f_0(980)\pi, f_0(1370)\pi$ waves.
- ¹³From a fit to $J^{PC} = 0^{-+} K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves.
- ¹⁴Superseded by AGHASYAN 2018B.

NODE=M075W;LINKAGE=B
NODE=M075W;LINKAGE=SP
NODE=M075W;LINKAGE=C1
NODE=M075W;LINKAGE=C2
NODE=M075W;LINKAGE=AX
NODE=M075W;LINKAGE=A
NODE=M075W;LINKAGE=C

$\pi(1800)$ DECAY MODES

NODE=M075215;NODE=M075

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^+ \pi^- \pi^-$	seen
$\Gamma_2 f_0(500)\pi^-$	seen
$\Gamma_3 f_0(980)\pi^-$	seen
$\Gamma_4 f_0(1370)\pi^-$	seen
$\Gamma_5 f_0(1500)\pi^-$	not seen
$\Gamma_6 \rho \pi^-$	not seen
$\Gamma_7 \eta \eta \pi^-$	seen

DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=12
DESIG=2
DESIG=7;OUR EST;→ UNCHECKED ←

Γ_8	$a_0(980)\eta$	seen	DESIG=5;OUR EST;→ UNCHECKED ←
Γ_9	$a_2(1320)\eta$	not seen	DESIG=13
Γ_{10}	$f_2(1270)\pi$	not seen	DESIG=14
Γ_{11}	$f_0(1370)\pi^-$	not seen	DESIG=15
Γ_{12}	$f_0(1500)\pi^-$	seen	DESIG=6;OUR EST;→ UNCHECKED ←
Γ_{13}	$\eta\eta'(958)\pi^-$	seen	DESIG=8;OUR EST;→ UNCHECKED ←
Γ_{14}	$K_0^*(1430)K^-$	seen	DESIG=4
Γ_{15}	$K^*(892)K^-$	not seen	DESIG=9

$\pi(1800)$ BRANCHING RATIOS

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$ Γ_3/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.44±0.08±0.38	15 CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M075220

NODE=M075R11
NODE=M075R11

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$ Γ_3/Γ_4

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.7±1.3	16 AMELIN	95B	VES	— 36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M075R5
NODE=M075R5

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	BELLINI	82	SPEC	— 40 $\pi^- A \rightarrow 3\pi A$

NODE=M075R1
NODE=M075R1

$\Gamma(f_0(1500)\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M075R12
NODE=M075R12

$\Gamma(\rho\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	BELLINI	82	SPEC	— 40 $\pi^- A \rightarrow 3\pi A$

NODE=M075R2
NODE=M075R2

$\Gamma(\rho\pi^-)/\Gamma(f_0(980)\pi^-)$ Γ_6/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.25		CHUNG	02	B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
<0.14	90	AMELIN	95B	VES	— 36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

NODE=M075R6
NODE=M075R6

$\Gamma(\eta\eta\pi^-)/\Gamma(\pi^+ \pi^- \pi^-)$ Γ_7/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.5±0.1	1200	16 AMELIN	96B	VES	— 37 $\pi^- A \rightarrow \eta\eta\pi^- A$

NODE=M075R8
NODE=M075R8

$\Gamma(a_2(1320)\eta)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$

NODE=M075R13
NODE=M075R13

$\Gamma(f_2(1270)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$

NODE=M075R14
NODE=M075R14

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
not seen	EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta\eta\pi^- p$

NODE=M075R15
NODE=M075R15

$\Gamma(f_0(1500)\pi^-)/\Gamma(a_0(980)\eta)$ Γ_{12}/Γ_8

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.48 ±0.17	4k	16,17 EUGENIO	08	B852	— 18 $\pi^- p \rightarrow \eta\eta\pi^- p$
0.030 ^{+0.014} _{-0.011}		16 ANISOVICH	01B	SPEC	0 0.6–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0\pi^0$
0.08 ±0.03	1200	16,18 AMELIN	96B	VES	— 37 $\pi^- A \rightarrow \eta\eta\pi^- A$

NODE=M075R7
NODE=M075R7

$\Gamma(\eta\eta'(958)\pi^-)/\Gamma(\eta\eta\pi^-)$ Γ_{13}/Γ_7

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.29 ± 0.07		¹⁶ BELADIDZE	92C	VES	— 36 π^- Be → $\pi^- \eta' \eta$ Be
0.3 ± 0.1	426 ± 57	¹⁶ BITYUKOV	91	VES	— 36 π^- C → $\pi^- \eta \eta$ C

NODE=M075R10
NODE=M075R10

 $\Gamma(K_0^*(1430)K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

seen BERDNIKOV 94 VES — 37 π^- A → $K^+ K^- \pi^-$ A

NODE=M075R4
NODE=M075R4

 $\Gamma(K^*(892)K^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

not seen BERDNIKOV 94 VES — 37 π^- A → $K^+ K^- \pi^-$ A

NODE=M075R9
NODE=M075R9

¹⁵ Assuming that $f_0(980)$ decays only to $\pi\pi$.

¹⁶ Systematic errors not estimated.

¹⁷ From a single-pole fit.

¹⁸ Assuming that $f_0(1500)$ decays only to $\eta\eta$ and $a_0(980)$ decays only to $\eta\pi$.

NODE=M075R;LINKAGE=CK
NODE=M075R5;LINKAGE=NS
NODE=M075R7;LINKAGE=SP
NODE=M075R7;LINKAGE=A

 $\pi(1800)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
EUGENIO	08	PL B660 466	P. Eugenio <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
AMELIN	96B	PAN 59 976	D.V. Amelin <i>et al.</i>	(SERP, TBIL) IGJPC
		Translated from YAF 59 1021.		
AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV	94	PL B337 219	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
BELADIDZE	92C	SJNP 55 1535	G.M. Beladidze, S.I. Bityukov, G.V. Borisov	(SERP+)
		Translated from YAF 55 2748.		
BITYUKOV	91	PL B268 137	S.I. Bityukov <i>et al.</i>	(SERP, TBIL)
BELLINI	82	PRL 48 1697	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)

NODE=M075

REFID=59471
REFID=53356
REFID=52160
REFID=48837
REFID=48318
REFID=46910

REFID=44725

REFID=44433
REFID=44073
REFID=43175

REFID=41749
REFID=21134

NODE=M038

$f_2(1810)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M038

 $f_2(1810)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1815 ± 12 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1822	+29 -24	+66 -57	5.5k	¹ ABLIKIM 13N BES3 $e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$

1737	± 9	+198 -65		² UEHARA 10A BELL $10.6 e^+e^- \rightarrow e^+e^- \eta\eta$

1800	± 30		40	ALDE 88D GAM4 $300 \pi^- p \rightarrow \pi^- p 4\pi^0$

1806	± 10		1600	ALDE 87 GAM4 $100 \pi^- p \rightarrow 4\pi^0 n$

1870	± 40			³ ALDE 86D GAM4 $100 \pi^- p \rightarrow \eta\eta n$

1857	+35 -24			⁴ COSTA 80 OMEG $10 \pi^- p \rightarrow K^+ K^- n$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1845.0 ± 2.2 ⁺ _{-7.2}		⁵ ALBRECHT 20 RVUE	0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$

1858	+18 -71	⁶ LONGACRE 86 RVUE	Compilation

1799	± 15	⁷ CASON 82 STRC	$8 \pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Breit-Wigner mass. Could also be the $f_2(1910)$.

³ Seen in only one solution.

⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.

⁵ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).

⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

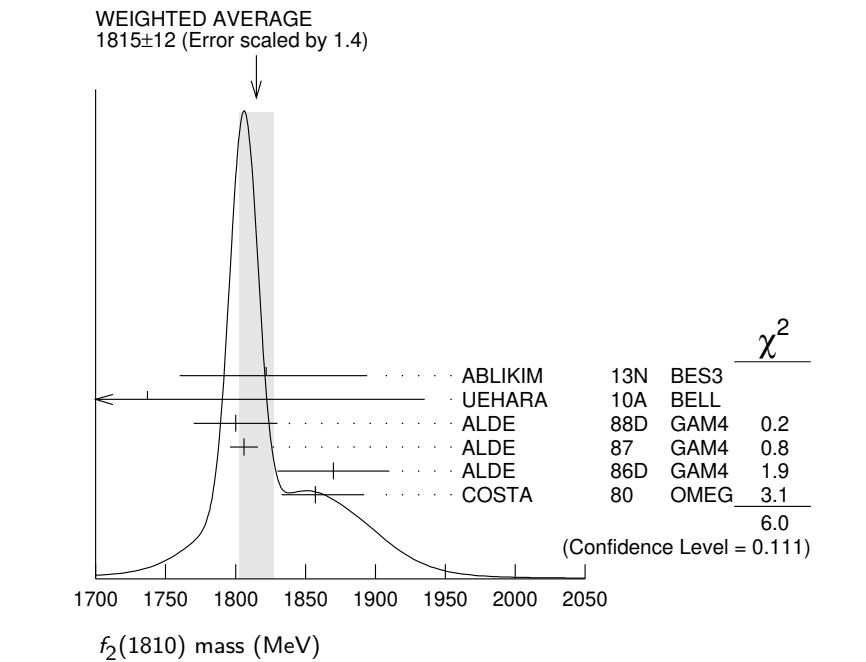
NODE=M038M;LINKAGE=B

NODE=M038M;LINKAGE=UE
NODE=M038M;LINKAGE=F
NODE=M038M;LINKAGE=A
NODE=M038M;LINKAGE=C

NODE=M038M;LINKAGE=L

⁷ From an amplitude analysis of the reaction $\pi^+\pi^-\rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038M;LINKAGE=P1



$f_2(1810)$ WIDTH

NODE=M038W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
197 ± 22	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
229 +52 -42	+88 -155	5.5k	1 ABLIKIM	13N BES3 $e^+e^-\rightarrow J/\psi\rightarrow \gamma\eta\eta$
228 +21 -20	+234 -153		2 UEHARA	10A BELL $10.6 e^+e^-\rightarrow e^+e^-\eta\eta$
160 ± 30	40		ALDE	88D GAM4 $300 \pi^-p\rightarrow \pi^-p4\pi^0$
190 ± 20	1600		ALDE	87 GAM4 $100 \pi^-p\rightarrow 4\pi^0n$
250 ± 30			3 ALDE	86D GAM4 $100 \pi^-p\rightarrow \eta\eta n$
185 +102 -139			4 COSTA	80 OMEG $10 \pi^-p\rightarrow K^+K^-n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260.9 ± 3.9	+199.9 -38.2		5 ALBRECHT	20 RVUE $0.9 \bar{p}p\rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
388 +15 -21			6 LONGACRE	86 RVUE Compilation
280 +42 -35			7 CASON	82 STRC $8 \pi^+p\rightarrow \Delta^{++}\pi^0\pi^0$

NODE=M038W

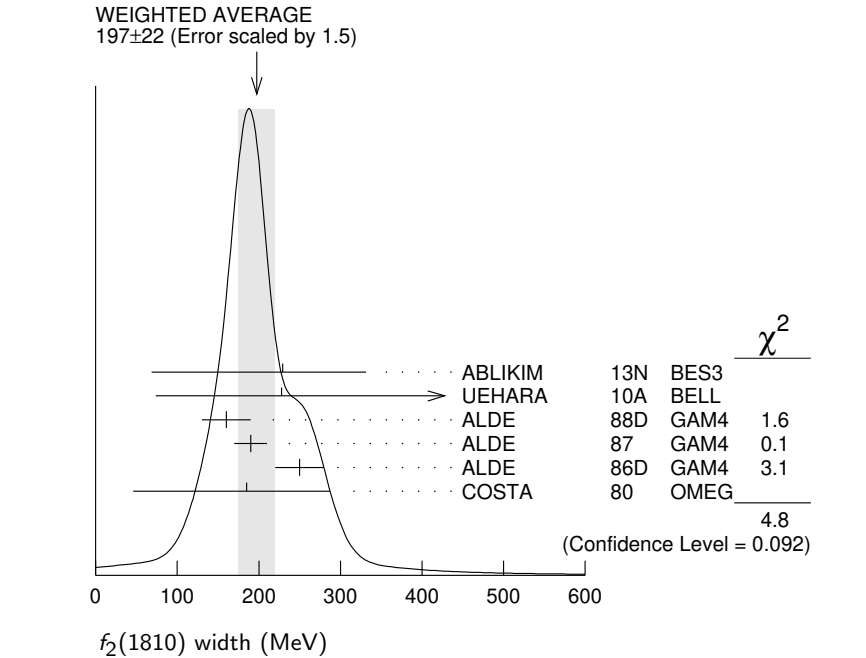
¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
² Breit-Wigner width. Could also be the $f_2(1910)$.
³ Seen in only one solution.
⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
⁵ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).
⁶ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
⁷ From an amplitude analysis of the reaction $\pi^+\pi^-\rightarrow 2\pi^0$. The resonance in the $2\pi^0$ final state is not confirmed by PROKOSHKIN 97.

NODE=M038W;LINKAGE=B

NODE=M038W;LINKAGE=UE
NODE=M038W;LINKAGE=F
NODE=M038W;LINKAGE=A
NODE=M038W;LINKAGE=C

NODE=M038W;LINKAGE=L

NODE=M038W;LINKAGE=P1



$f_2(1810)$ DECAY MODES

Mode		Fraction (Γ_i/Γ)
Γ_1	$\pi\pi$	seen
Γ_2	$\eta\eta$	seen
Γ_3	$4\pi^0$	seen
Γ_4	K^+K^-	seen
Γ_5	$\gamma\gamma$	seen

NODE=M038215;NODE=M038

DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EST;→ UNCHECKED ←

$f_2(1810)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_5/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
$5.2^{+0.9}_{-0.8} + 37.3 - 4.5$	¹ UEHARA	10A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$	

NODE=M038225

NODE=M038G01
NODE=M038G01

¹ Including interference with the $f_2'(1525)$ (parameters fixed to the values from the 2008 edition of this review, PDG 08) and $f_2(1270)$. May also be the $f_0(1500)$.

NODE=M038G01;LINKAGE=UE

$f_2(1810)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen	AMSLER	02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$	
not seen	PROKOSHKIN	97	GAM2	38 $\pi^-p \rightarrow \pi^0\pi^0n$	
$0.21^{+0.02}_{-0.03}$	¹ LONGACRE	86	RVUE	Compilation	
0.44 ± 0.03	² CASON	82	STRC	8 $\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$	

NODE=M038220

NODE=M038R2
NODE=M038R2

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.
² Included in LONGACRE 86 global analysis.

NODE=M038R2;LINKAGE=L

NODE=M038R;LINKAGE=C

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	ABLIKIM	13N	BES3	PWA of $J/\psi \rightarrow \gamma\eta\eta$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.008^{+0.028}_{-0.003}$	¹ LONGACRE	86	RVUE	Compilation	

NODE=M038R3
NODE=M038R3

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R3;LINKAGE=L

$\Gamma(\pi\pi)/\Gamma(4\pi^0)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.75	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_1/Γ_3

NODE=M038R4
 NODE=M038R4

 $\Gamma(4\pi^0)/\Gamma(\eta\eta)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.8 ± 0.3	ALDE	87	GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$

 Γ_3/Γ_2

NODE=M038R5
 NODE=M038R5

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.003^{+0.019}_{-0.002}$	¹ LONGACRE	86	RVUE Compilation
seen	COSTA	80	OMEG 10 $\pi^- p \rightarrow K^+K^- n$

 Γ_4/Γ

NODE=M038R1
 NODE=M038R1

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R1;LINKAGE=L

 $f_2(1810)$ REFERENCES

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
PROKOSHKIN	97	PD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)
		Translated from DANS 353 323.		
ALDE	88D	SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
		Translated from YAF 47 1273.		
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)

NODE=M038

REFID=60439
 REFID=55387
 REFID=53641
 REFID=52166
 REFID=48580
 REFID=45386

REFID=44652

REFID=40221
 REFID=20765
 REFID=20768
 REFID=20750
 REFID=20746
 REFID=20737
 REFID=20355

 $X(1835)$

$$J^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Could be a superposition of two states, one with small width appearing as threshold enhancement in $p\bar{p}$, the other one with a larger width. For the former ABLIKIM 12D determine $J^{PC} = 0^-+.$

NODE=M085

NODE=M085

 $X(1835)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1826.5^{+13.0}_{-3.4}$ OUR AVERAGE				
$1825.3 \pm 2.4^{+17.3}_{-2.4}$		¹ ABLIKIM	16J	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
$1844 \pm 9^{+16}_{-25}$		² ABLIKIM	15T	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1839 \pm 26 \pm 26$		³ ABLIKIM	18I	BES3 $J/\psi \rightarrow \gamma \gamma \phi(1020)$
$1909.5 \pm 15.9^{+9.4}_{-27.5}$		⁴ ABLIKIM	16J	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
$1842.2 \pm 4.2^{+7.1}_{-2.6}$	0.6k	ABLIKIM	13U	BES3 $J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$
$1832^{+19}_{-5} \pm 26$		⁵ ABLIKIM	12D	BES3 $J/\psi \rightarrow \gamma p\bar{p}$
$1836.5 \pm 3.0^{+5.6}_{-2.1}$	4265	⁶ ABLIKIM	11C	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
$1877.3 \pm 6.3^{+3.4}_{-7.4}$		⁷ ABLIKIM	11J	BES3 $J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
$1837^{+10}_{-12} \pm 9$	231	^{8,9} ALEXANDER	10	CLEO $J/\psi \rightarrow \gamma p\bar{p}$
$1833.7 \pm 6.1 \pm 2.7$	264	ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
1831 ± 7		^{9,10} ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma p\bar{p}$
$1859^{+3}_{-10} \pm 5$		⁹ BAI	03F	BES2 $J/\psi \rightarrow \gamma p\bar{p}$

NODE=M085M

NODE=M085M

OCCUR=2

OCCUR=2

- ¹ From a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.
- ² Decay dominated by $f_0(980)\eta$ hence $I^G(J^{PC}) = 0^+(0^-+)$.
- ³ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^-+$. Other J^{PC} not excluded.
- ⁴ Pole mass from a fit of the measured $\pi^+\pi^-\eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.
- ⁵ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.
- ⁶ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma X(2370)$, for $M(\pi^+\pi^-\eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.
- ⁷ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$. This state may be due also to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.
- ⁸ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.
- ⁹ Evidence for a threshold enhancement in the $p\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p\bar{p}K^+$, WANG 05A in $B^0 \rightarrow p\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow p\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)p\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow p\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.
- ¹⁰ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085M;LINKAGE=B

NODE=M085M;LINKAGE=D
NODE=M085M;LINKAGE=C

NODE=M085M;LINKAGE=A

NODE=M085M;LINKAGE=AK

NODE=M085M;LINKAGE=AI

NODE=M085M;LINKAGE=BL

NODE=M085M;LINKAGE=AE

NODE=M085M;LINKAGE=HF

NODE=M085M;LINKAGE=AB

X(1835) WIDTH

NODE=M085W

NODE=M085W

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
242 $^{+14}_{-15}$ OUR AVERAGE					
245.2 $\pm$ 13.1 $^{+4.6}_{-9.6}$			¹ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
192 $^{+20}_{-17}$ $^{+62}_{-43}$			² ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
175 $\pm$ 57 $\pm$ 25			³ ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
273.5 $\pm$ 21.4 $^{+6.1}_{-64.0}$			⁴ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
83 $\pm$ 14 $\pm$ 11	0.6k		ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
< 76	90		⁵ ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$
190 $\pm$ 9 $^{+38}_{-36}$	4265		⁶ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
57 $\pm$ 12 $^{+19}_{-4}$			⁷ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
0 $^{+44}_{-0}$	231		^{8,9} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p\bar{p}$
67.7 $\pm$ 20.3 $\pm$ 7.7	264		ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
< 153	90		^{9,10} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$
< 30			⁹ BAI	03F BES2	$J/\psi \rightarrow \gamma p\bar{p}$

OCCUR=2

OCCUR=2

- ¹ From a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold through interference with a second previously unseen narrow resonance near 1870 MeV. The fit uses Breit-Wigner functions for the signal shapes and includes known backgrounds and contributors.
- ² Decay dominated by $f_0(980)\eta$ hence $I^G(J^{PC}) = 0^+(0^-+)$.
- ³ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^-+$. Other J^{PC} not excluded.
- ⁴ Pole width from a fit of the measured $\pi^+\pi^-\eta'$ lineshape to a Flatte formula that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold; the fit also includes known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner function ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit.
- ⁵ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.
- ⁶ From a fit of the $\pi^+\pi^-\eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma X(2370)$, for $M(\pi^+\pi^-\eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.
- ⁷ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$. This state may be due also to $\eta_2(1870)$ or to a combination of $X(1835)$ and $\eta_2(1870)$.
- ⁸ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M085W;LINKAGE=B

NODE=M085W;LINKAGE=D
NODE=M085W;LINKAGE=C

NODE=M085W;LINKAGE=A

NODE=M085W;LINKAGE=AK

NODE=M085W;LINKAGE=AI

NODE=M085W;LINKAGE=BL

NODE=M085W;LINKAGE=AE

- ⁹Evidence for a threshold enhancement in the $p\bar{p}$ mass spectrum was also reported by ABE 02K, AUBERT,B 05L, and WANG 05A in $B^+ \rightarrow p\bar{p}K^+$, WANG 05A in $B^0 \rightarrow p\bar{p}K_S^0$, ABE 02W in $\bar{B}^0 \rightarrow p\bar{p}D^0$, DEL-AMO-SANCHEZ 12 in $B \rightarrow D(D^*)p\bar{p}(\pi)$, and WEI 08 in $B^+ \rightarrow p\bar{p}\pi^+$ decays. Not seen by ATHAR 06 in $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.
- ¹⁰From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

NODE=M085215;NODE=M085

X(1835) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\eta'\pi^+\pi^-$	seen
Γ_3 $\gamma\gamma$	not seen
Γ_4 $K_S^0 K_S^0 \eta$	seen
Γ_5 $\gamma\phi(1020)$	possibly seen
Γ_6 $3(\pi^+\pi^-)$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7

X(1835) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_3/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<35.6	90	¹ ZHANG	12A	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

<83	90	² ZHANG	12A	BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

¹From a two-resonance fit and constructive interference of the $\eta(1760)$ and X(1835), a significance of 2.8 σ .

²From a two-resonance fit and destructive interference of the $\eta(1760)$ and X(1835), a significance of 2.8 σ .

NODE=M085225

NODE=M085G01
NODE=M085G01

OCCUR=2

NODE=M085G01;LINKAGE=ZH

NODE=M085G01;LINKAGE=ZA

X(1835) BRANCHING RATIOS

$\Gamma(p\bar{p})/\Gamma(\eta'\pi^+\pi^-)$ Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.333	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

$\Gamma(\eta'\pi^+\pi^-)/\Gamma(K_S^0 K_S^0 \eta)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.7 ± 1.8	¹ ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

¹Using resutls from ABLIKIM 05R.

NODE=M085220

NODE=M085R01
NODE=M085R01

NODE=M085R00
NODE=M085R00

NODE=M085R00;LINKAGE=A

$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

¹ABLIKIM 16J quotes $B(J/\psi \rightarrow \gamma X(1835)) \times B(X(1835) \rightarrow \pi^+\pi^-\eta') = (3.93 \pm 0.38^{+0.31}_{-0.84}) \times 10^{-4}$ from a fit of the measured $\pi^+\pi^-\eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the X(1835); fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

NODE=M085R03
NODE=M085R03

NODE=M085R03;LINKAGE=A

$\Gamma(\gamma\phi(1020))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

possibly seen	¹ ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$

¹Seen as a peak in $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

NODE=M085R04
NODE=M085R04

NODE=M085R04;LINKAGE=A

$\Gamma(\gamma\gamma)/\Gamma(\eta'\pi^+\pi^-)$ Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<9.80 \times 10^{-3}$	90	¹ ABLIKIM	18O	BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

¹Using results from ABLIKIM 16J.

NODE=M085R05
NODE=M085R05

NODE=M085R05;LINKAGE=A

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$

NODE=M085R06
 NODE=M085R06

X(1835) REFERENCES

ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	16J	PRL 117 042002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.) JPC
DEL-AMO-SA...	12	PR D85 092017	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	10G	CP C34 421	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
WEI	08	PL B659 80	J.-T. Wei <i>et al.</i>	(BELLE Collab.)
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT,B	05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer	
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)
ABE	02K	PRL 88 181803	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	02W	PRL 89 151802	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M085

REFID=58893
 REFID=58925
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 REFID=56785
 REFID=55582
 REFID=54269
 REFID=54286
 REFID=54763
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 REFID=55685
 REFID=53525
 REFID=52086
 REFID=50993
 REFID=50985
 REFID=50827
 REFID=51038
 REFID=50651
 REFID=49473
 REFID=48690
 REFID=48980

NODE=M054

 $\phi_3(1850)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

 $\phi_3(1850)$ MASS

NODE=M054M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1854 ± 7 OUR AVERAGE				
1855 ± 10		ASTON	88E LASS	$11 K^- p \rightarrow K^- K^+ \Lambda,$ $K_S^0 K^\pm \pi^\mp \Lambda$
1870^{+30}_{-20}	430	ARMSTRONG	82 OMEG	$18.5 K^- p \rightarrow$ $K^- K^+ \Lambda$
1850 ± 10	123	ALHARRAN	81B HBC	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054M

 $\phi_3(1850)$ WIDTH

NODE=M054W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
87^{+28}_{-23} OUR AVERAGE	Error includes scale factor of 1.2.			
64 ± 31		ASTON	88E LASS	$11 K^- p \rightarrow K^- K^+ \Lambda,$ $K_S^0 K^\pm \pi^\mp \Lambda$
160^{+90}_{-50}	430	ARMSTRONG	82 OMEG	$18.5 K^- p \rightarrow$ $K^- K^+ \Lambda$
80^{+40}_{-30}	123	ALHARRAN	81B HBC	$8.25 K^- p \rightarrow K \bar{K} \Lambda$

NODE=M054W

 $\phi_3(1850)$ DECAY MODES

NODE=M054215;NODE=M054

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $K K^*(892) + \text{c.c.}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←

 $\phi_3(1850)$ BRANCHING RATIOS

NODE=M054220

 $\Gamma(K \bar{K}^*(892) + \text{c.c.})/\Gamma(K \bar{K})$ Γ_2/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
$0.55^{+0.85}_{-0.45}$	ASTON	88E LASS	$11 K^- p \rightarrow K^- K^+ \Lambda,$ $K_S^0 K^\pm \pi^\mp \Lambda$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.8 ± 0.4	ALHARRAN	81B HBC	$8.25 K^- p \rightarrow K \bar{K} \pi \Lambda$

NODE=M054R1
 NODE=M054R1

 $\phi_3(1850)$ REFERENCES

NODE=M054

ASTON	88E	PL B208 324	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) IGJPC
ARMSTRONG	82	PL 110B 77	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP
ALHARRAN	81B	PL 101B 357	S. Al-Harran <i>et al.</i>	(BIRM, CERN, GLAS+)

REFID=40577
 REFID=21405
 REFID=21702

NODE=M267

$\eta_1(1855)$

$I^G(J^{PC}) = 0^+(1^-+)$

OMITTED FROM SUMMARY TABLE

Meson with exotic (non- $q\bar{q}$) quantum numbers. A state decaying into $\eta\eta'$ with possible quantum numbers 1^-+ was reported earlier in this mass region BARBERIS 00A in high energy central pp production and by ALDE 91B in π^-p interactions, see the $f_2(1910)$, and the review on "Spectroscopy of Light Meson Resonances."

NODE=M267

$\eta_1(1855)$ MASS

NODE=M267M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$1855\pm 9^{+6}_{-1}$	¹ ABLIKIM	22AI BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$

NODE=M267M

¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P -wave. For analysis details see ABLIKIM 22AS.

NODE=M267M;LINKAGE=A

$\eta_1(1855)$ WIDTH

NODE=M267W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$188\pm 18^{+3}_{-8}$	¹ ABLIKIM	22AI BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta'$

NODE=M267W

¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta\eta'$ P -wave. For analysis details see ABLIKIM 22AS.

NODE=M267W;LINKAGE=A

$\eta_1(1855)$ DECAY MODES

NODE=M267215;NODE=M267

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta\eta'$	seen

DESIG=1

$\Gamma(\eta\eta')/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	ABLIKIM	22AI BES3	$J/\psi \rightarrow \gamma\eta\eta'$	
seen	BARBERIS	00A	$450\ pp \rightarrow p_f\eta\eta'\ p_s$	
seen	ALDE	91B GAM2	$38\ \pi^-p \rightarrow \eta\eta' n$	

NODE=M267R00
NODE=M267R00

$\eta_1(1855)$ REFERENCES

NODE=M267

ABLIKIM	22AI	PRL 129 192002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
Translated from YAF 54 751.				

REFID=61881
REFID=61891
REFID=61891
REFID=62033
REFID=47957
REFID=41844

$\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

NODE=M101

 $\eta_2(1870)$ MASS

NODE=M101M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1842± 8 OUR AVERAGE				
1835±12		BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
1844±13		BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
1840±25		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
1875±20±35		ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1881±32±40	26	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1860± 5±15		ANISOVICH	00E SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
1840±15		BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101M

 $\eta_2(1870)$ WIDTH

NODE=M101W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
225±14 OUR AVERAGE				
235±22		BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
228±23		BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
200±40		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$
200±25±45		ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
221±92±44	26	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^- \eta \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
250±25 ⁺⁵⁰ ₋₃₅		ANISOVICH	00E SPEC	0.9–1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
170±40		BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M101W

 $\eta_2(1870)$ DECAY MODES

NODE=M101225;NODE=M101

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta \pi \pi$	seen
Γ_2 $a_2(1320) \pi$	seen
Γ_3 $f_2(1270) \eta$	seen
Γ_4 $a_0(980) \pi$	seen
Γ_5 $\gamma \gamma$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=9

 $\eta_2(1870)$ BRANCHING RATIOS

NODE=M101230

 $\Gamma(a_2(1320)\pi)/\Gamma(f_2(1270)\eta)$ Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.7 ±0.4 OUR AVERAGE			
1.60±0.40	¹ ANISOVICH	11 SPEC	0.9–1.94 $p\bar{p}$
20.4 ±6.6	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
4.1 ±2.3	ADOMEIT	96 CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.NODE=M101R2
NODE=M101R2 $\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi)$ Γ_2/Γ_4

VALUE	DOCUMENT ID	COMMENT
32.6±12.6	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M101R4
NODE=M101R4 $\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta)$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.48±0.45	¹ ANISOVICH	11 SPEC	0.9–1.94 $p\bar{p}$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.NODE=M101R01
NODE=M101R01 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^- \eta \pi^0 \pi^0$

NODE=M101R01;LINKAGE=AN

NODE=M101R02
NODE=M101R02

$\eta_2(1870)$ REFERENCES

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KARCH	92	ZPHY C54 33	K. Karch <i>et al.</i>	(Crystal Ball Collab.)

NODE=M101

REFID=53631
REFID=47945
REFID=47958
REFID=47959
REFID=46606
REFID=45758
REFID=45202
REFID=42170

 $\pi_2(1880)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M185

 $\pi_2(1880)$ MASS

NODE=M185M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M185M

1874⁺²⁶₋₅ OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.

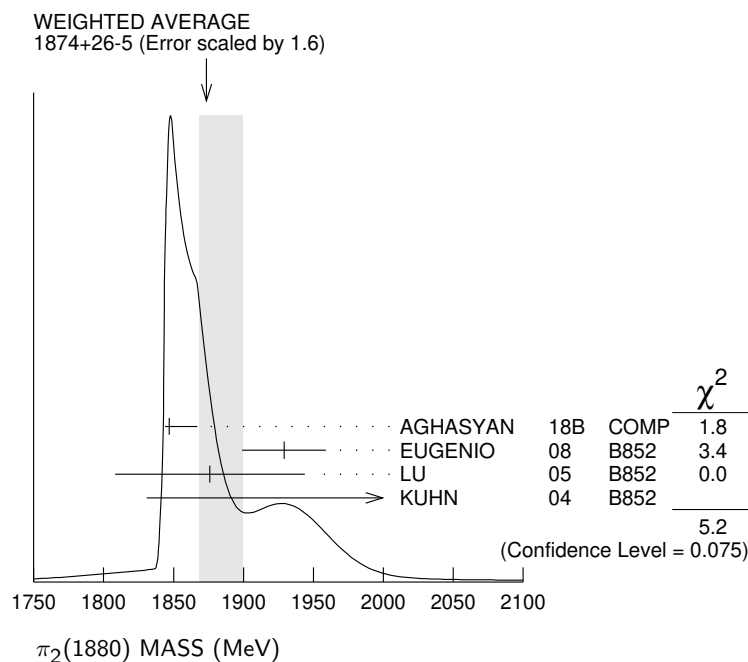
1847 ⁺²⁰ ₋₃	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1929 $\pm$ 24 $\pm$ 18	4k	EUGENIO	08	B852	— 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1876 $\pm$ 11 $\pm$ 67	145k	LU	05	B852	— 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
2003 $\pm$ 88 $\pm$ 148	69k	KUHN	04	B852	— 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1880 $\pm$ 20		ANISOVICH	01B	SPEC	0 0.6–1.94 $\bar{p} p \rightarrow \eta \eta \pi^0 \pi^0$

¹ Statistical error negligible.

NODE=M185M;LINKAGE=A

 $\pi_2(1880)$ WIDTH

NODE=M185W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M185W

237⁺³³₋₃₀ OUR AVERAGE Error includes scale factor of 1.2.

246 ⁺³³ ₋₂₈	46M	² AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
323 $\pm$ 87 $\pm$ 43	4k	EUGENIO	08	B852	— 18 $\pi^- p \rightarrow \eta \eta \pi^- p$
146 $\pm$ 17 $\pm$ 62	145k	LU	05	B852	— 18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
306 $\pm$ 132 $\pm$ 121	69k	KUHN	04	B852	— 18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

255 $\pm$ 45		ANISOVICH	01B	SPEC	0 0.6–1.94 $\bar{p} p \rightarrow \eta \eta \pi^0 \pi^0$

² Statistical error negligible.

NODE=M185W;LINKAGE=A

$\pi_2(1880)$ DECAY MODES

NODE=M185215;NODE=M185

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\eta\pi^-$	seen
Γ_2 $a_0(980)\eta$	seen
Γ_3 $a_2(1320)\eta$	seen
Γ_4 $f_0(1500)\pi$	seen
Γ_5 $f_1(1285)\pi$	seen
Γ_6 $\omega\pi^-\pi^0$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=6;OUR EVAL;→ UNCHECKED ←

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$ Γ_3/Γ_5

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

22.7±7.3	69k	KUHN	04	B852	—	18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$

NODE=M185R01
 NODE=M185R01

 $\Gamma(f_0(1500)\pi)/\Gamma(a_0(980)\eta)$ Γ_4/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.28 ^{+0.20} _{-0.15}	³ ANISOVICH	01B	SPEC	0	0.6–1.94 $\bar{p}p \rightarrow \eta\eta\pi^0\pi^0$

³ Systematic errors not estimated.

NODE=M185R02
 NODE=M185R02

NODE=M185R02;LINKAGE=NS

 $\pi_2(1880)$ REFERENCES

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
EUGENIO	08	PL B660 466	P. Eugenio <i>et al.</i>	(BNL E852 Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01B	PL B500 222	A.V. Anisovich <i>et al.</i>	

NODE=M185

REFID=59471
 REFID=52160
 REFID=50459
 REFID=49773
 REFID=48318

NODE=M170

 $\rho(1900)$

$$I^G(J^{PC}) = 1^+(1^- -)$$

OMITTED FROM SUMMARY TABLE

See the review on "Spectroscopy of Light Meson Resonances."

NODE=M170

 $\rho(1900)$ MASS

NODE=M170M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1880±10		¹ ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \rightarrow K^+K^-\pi^0$
1909±17±25	54	² AUBERT	08S	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
1880±30		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 3\pi^+3\pi^-\gamma$
1860±20		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
1910±10		^{3,4} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-\pi^0$
1870±10		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

OCCUR=2

¹ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

² From the fit with two resonances.³ From a fit with two resonances with the JACOB 72 continuum.⁴ Supersedes FRABETTI 01.

NODE=M170M;LINKAGE=A

NODE=M170M;LINKAGE=AU
 NODE=M170M;LINKAGE=PI
 NODE=M170M;LINKAGE=RS

 $\rho(1900)$ WIDTH

NODE=M170W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

69±15		¹ ABLIKIM	22L	BES3	2.0–3.08 $e^+e^- \rightarrow K^+K^-\pi^0$
48±17±2	54	² AUBERT	08S	BABR	10.6 $e^+e^- \rightarrow \phi\pi^0\gamma$
130±30		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 3\pi^+3\pi^-\gamma$
160±20		AUBERT	06D	BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$
37±13		^{3,4} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-\pi^0$
10±5		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

OCCUR=2

¹ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.
² From the fit with two resonances.
³ From a fit with two resonances with the JACOB 72 continuum.
⁴ Supersedes FRABETTI 01.

NODE=M170W;LINKAGE=A

NODE=M170W;LINKAGE=AU
NODE=M170W;LINKAGE=PI
NODE=M170W;LINKAGE=RS

$\rho(1900) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$					
$\Gamma(\phi\pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$				$\Gamma_4 / \Gamma \times \Gamma_6 / \Gamma$	
VALUE (units 10^{-8})	EVTs	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.2 \pm 1.2 \pm 0.8$	54	¹ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$	
¹ From the fit with two resonances.					

NODE=M170215

NODE=M170B01
NODE=M170B01

NODE=M170B01;LINKAGE=AU

$\rho(1900)$ DECAY MODES		
Mode	Fraction (Γ_i / Γ)	
Γ_1 6π	seen	
Γ_2 $3\pi^+ 3\pi^-$	seen	
Γ_3 $2\pi^+ 2\pi^- 2\pi^0$		
Γ_4 $\phi\pi$	seen	
Γ_5 hadrons	seen	
Γ_6 $e^+ e^-$	seen	
Γ_7 $N N$	not seen	

NODE=M170225;NODE=M170

DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

$\rho(1900)$ BRANCHING RATIOS				
$\Gamma(6\pi) / \Gamma_{\text{total}}$			Γ_1 / Γ	
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	8k	AKHMETSHIN 13	CMD3	$e^+ e^- \rightarrow 3\pi^+ 3\pi^-$
not seen		AGNELLO 02	OBLX	$\bar{n} p \rightarrow 3\pi^+ 2\pi^- \pi^0$
seen		FRABETTI 01	E687	$\gamma p \rightarrow 3\pi^+ 3\pi^- p$
seen		ANTONELLI 96	SPEC	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M170230

NODE=M170R1
NODE=M170R1

$\rho(1900)$ REFERENCES				
ABLIKIM 22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)	
AKHMETSHIN 13	PL B723 82	R.R. Akhmetshin <i>et al.</i>	(CMD-3 Collab.)	
AUBERT 08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	
AUBERT 06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	
FRABETTI 04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	
AGNELLO 02	PL B527 39	M. Agnello <i>et al.</i>	(OBELIX Collab.)	
FRABETTI 01	PL B514 240	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	
ANTONELLI 96	PL B365 427	A. Antonelli <i>et al.</i>	(FENICE Collab.)	
JACOB 72	PR D5 1847	M. Jacob, R. Slansky		

NODE=M170

REFID=61649
REFID=55370
REFID=52242
REFID=51047
REFID=49614
REFID=48576
REFID=48350
REFID=44633
REFID=49668

$f_2(1910)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE

We list here three different peaks with close masses and widths seen in the mass distributions of $\omega\omega$, $\eta\eta'$, and K^+K^- final states. ALDE 91B argues that they are of different nature.

NODE=M142

NODE=M142

$f_2(1910)$ MASS

NODE=M142205

NODE=M142MX

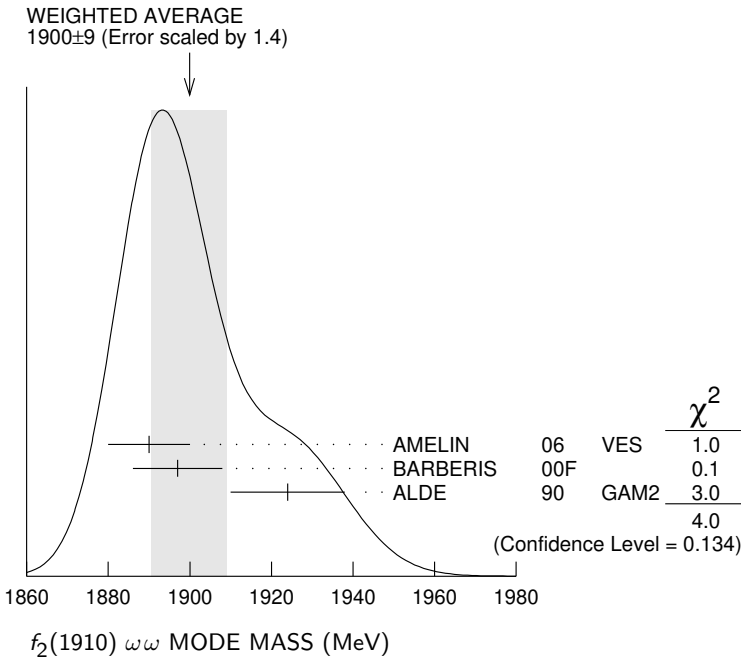
$f_2(1910)$ $\omega\omega$ MODE

NODE=M142M2
NODE=M142M2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1900 ± 9 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.		
1890 ± 10	¹ AMELIN	06 VES	$36 \pi^- p \rightarrow \omega\omega n$
1897 ± 11	BARBERIS	00F	$450 p p \rightarrow p_f \omega\omega p_s$
1924 ± 14	ALDE	90 GAM2	$38 \pi^- p \rightarrow \omega\omega n$

¹ Supersedes BELADIDZE 92B.

NODE=M142M2;LINKAGE=AM



$f_2(1910)$ $\eta\eta'$ MODE

NODE=M142M3
NODE=M142M3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934 ± 16	¹ BARBERIS	00A	$450 p p \rightarrow p_f \eta\eta' p_s$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1934 ± 20	² ANISOVICH	00J	SPEC
1911 ± 10	ALDE	91B	GAM2 $38 \pi^- p \rightarrow \eta\eta' n$

¹ Also compatible with $J^{PC} = 1^-+$.
² Combined fit with $\eta\eta$, $\pi\pi$, and $\eta\pi\pi$.

NODE=M142M3;LINKAGE=KS
NODE=M142M3;LINKAGE=AN

$f_2(1910)$ K^+K^- MODE

NODE=M142M4
NODE=M142M4

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1941 ± 18	¹ AMSLER	06	CBAR $1.64 \bar{p} p \rightarrow K^+ K^- \pi^0$
¹ Tentative, could be $f_2(1950)$.			

NODE=M142M4;LINKAGE=A

$f_2(1910)$ WIDTH

NODE=M142210

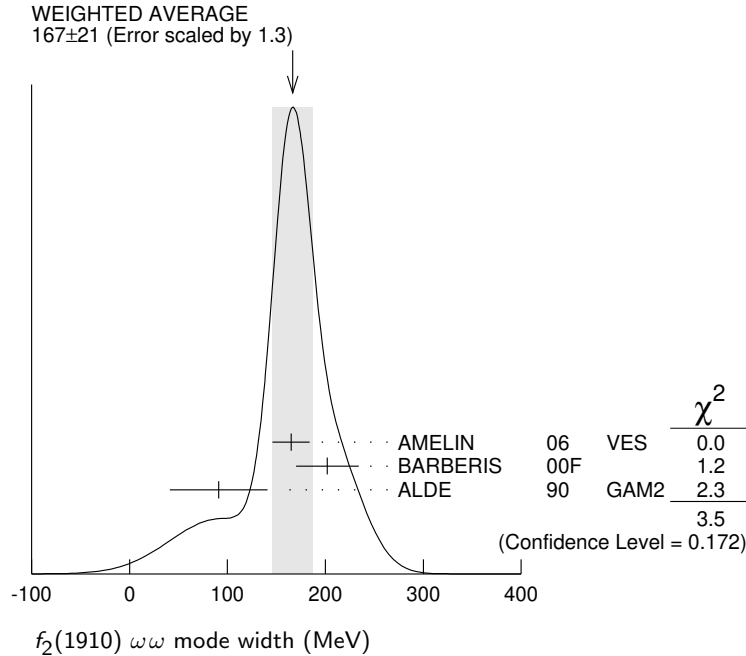
NODE=M142WX

NODE=M142W2
NODE=M142W2 **$f_2(1910)$ $\omega\omega$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
167 ± 21 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
165 ± 19	¹ AMELIN	06	VES $36 \pi^- p \rightarrow \omega\omega n$
202 ± 32	BARBERIS	00F	450 $pp \rightarrow p_f \omega\omega p_s$
91 ± 50	ALDE	90	GAM2 $38 \pi^- p \rightarrow \omega\omega n$

¹ Supersedes BELADIDZE 92B.

NODE=M142W2;LINKAGE=AM

 **$f_2(1910)$ $\eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
140 ± 40 OUR AVERAGE	[141 $\pm$ 40 MeV OUR 2023 AVERAGE]		
141 ± 41	¹ BARBERIS	00A	450 $pp \rightarrow p_f \eta\eta' p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

271 ± 25	² ANISOVICH	00J	SPEC
90 ± 35	ALDE	91B	GAM2 $38 \pi^- p \rightarrow \eta\eta' n$

¹ Also compatible with $J^{PC}=1^-+$.² Combined fit with $\eta\eta$, $\pi\pi$, and $\eta\pi\pi$.NODE=M142W3
NODE=M142W3

NEW

NODE=M142W3;LINKAGE=KS
NODE=M142W3;LINKAGE=AN **$f_2(1910)$ K^+K^- MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
120 ± 40	AMSLER	06	CBAR $1.64 \bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M142W4
NODE=M142W4 **$f_2(1910)$ DECAY MODES**

NODE=M142215;NODE=M142

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^0 \pi^0$	
$\Gamma_2 K^+ K^-$	seen
$\Gamma_3 K_S^0 K_S^0$	
$\Gamma_4 \eta\eta$	seen
$\Gamma_5 \omega\omega$	seen
$\Gamma_6 \eta\eta'$	seen
$\Gamma_7 \eta'\eta'$	
$\Gamma_8 \rho\rho$	seen
$\Gamma_9 a_2(1320)\pi$	seen
$\Gamma_{10} f_2(1270)\eta$	seen

DESIG=6

DESIG=11

DESIG=8

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=9

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=12;OUR EST;→ UNCHECKED ←

DESIG=13;OUR EST;→ UNCHECKED ←

$f_2(1910)$ BRANCHING RATIOS **$\Gamma(K^+K^-)/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AMSLER	06	CBAR 1.64 $\bar{p}p \rightarrow K^+K^-\pi^0$

¹ Tentative, could be $f_2(1950)$.

NODE=M142225

NODE=M142R11
NODE=M142R11

NODE=M142R11;LINKAGE=A

 $\Gamma(\pi^0\pi^0)/\Gamma(\eta\eta')$ **Γ_1/Γ_6**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			

<0.1 ALDE 89 GAM2 $38\pi^-p \rightarrow \eta\eta'n$ NODE=M142R4
NODE=M142R4 **$\Gamma(K_S^0K_S^0)/\Gamma(\eta\eta')$** **$\Gamma_3/\Gamma_6$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				

<0.066 90 BALOSHIN 86 SPEC $40\pi p \rightarrow K_S^0K_S^0n$ NODE=M142R7
NODE=M142R7 **$\Gamma(\eta\eta)/\Gamma(\eta\eta')$** **$\Gamma_4/\Gamma_6$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				

<0.05 90 ALDE 91B GAM2 $38\pi^-p \rightarrow \eta\eta'n$ NODE=M142R6
NODE=M142R6 **$\Gamma(\omega\omega)/\Gamma(\eta\eta')$** **$\Gamma_5/\Gamma_6$**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		

2.6±0.6 BARBERIS 00F 450 $pp \rightarrow p_f\omega\omega p_S$ NODE=M142R10
NODE=M142R10 **$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$** **$\Gamma_7/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			

probably not seen BARBERIS 00A 450 $pp \rightarrow p_f\eta'\eta'p_S$
possibly seen BELADIDZE 92D VES $37\pi^-p \rightarrow \eta'\eta'n$ NODE=M142R8
NODE=M142R8 **$\Gamma(\rho\rho)/\Gamma(\omega\omega)$** **$\Gamma_8/\Gamma_5$**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		

2.6±0.4 BARBERIS 00F 450 $pp \rightarrow p_f\omega\omega p_S$ NODE=M142R9
NODE=M142R9 **$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$** **$\Gamma_{10}/\Gamma_9$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.09±0.05	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.NODE=M142R12
NODE=M142R12

NODE=M142R12;LINKAGE=AN

 $f_2(1910)$ REFERENCES

NODE=M142

ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)	REFID=53631
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>		REFID=47945
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BARBERIS	00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47957
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45202
BELADIDZE	92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=42172
BELADIDZE	92D	ZPHY C57 13	G.M. Beladidze <i>et al.</i>	(VES Collab.)	REFID=43309
ALDE	91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=41844
		Translated from YAF 54 751.			
Also		PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)	REFID=41911
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
ALDE	89	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)	REFID=40727
Also		SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)	REFID=44697
		Translated from YAF 48 1724.			
BALOSHIN	86	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)	REFID=40734
		Translated from YAF 43 1487.			

$a_0(1950)$

$I^G(J^{PC}) = 1^-(0^{++})$

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen in $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$ by LEES 16A with significance 2.5 σ in $K_S^0 K^\pm \pi^\mp$ and 4.2 σ in $K^+ K^- \pi^0$.

NODE=M227

NODE=M227

$a_0(1950)$ MASS

NODE=M227M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1931 \pm 14 \pm 22$	12k	^{1,2} LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1949 \pm 32 \pm 76$	8k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$1927 \pm 15 \pm 23$	4k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$
¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating width.				
² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.				

NODE=M227M

OCCUR=3

OCCUR=2

NODE=M227M;LINKAGE=A

NODE=M227M;LINKAGE=B

$a_0(1950)$ WIDTH

NODE=M227W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
270 ± 40 OUR AVERAGE	[271 $\pm$ 40 MeV OUR 2023 AVERAGE]			
$271 \pm 22 \pm 29$	12k	^{1,2} LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$265 \pm 36 \pm 110$	8k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$
$274 \pm 28 \pm 30$	4k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K^+ K^- \pi^0$
¹ From a model-independent partial wave analysis fit to a relativistic Breit-Wigner function with a floating mass.				
² Weighted average of the $K_S^0 K^\pm$ and $K^+ K^-$ decay modes.				

NODE=M227W

NEW

OCCUR=3

OCCUR=2

NODE=M227W;LINKAGE=A

NODE=M227W;LINKAGE=B

$a_0(1950)$ DECAY MODES

NODE=M227215;NODE=M227

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\bar{K}$	seen

DESIG=1

$a_0(1950)$ BRANCHING RATIOS

NODE=M227225

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
¹ From a model-independent partial wave analysis.				

NODE=M227R01

NODE=M227R01

NODE=M227R01;LINKAGE=A

$a_0(1950)$ REFERENCES

NODE=M227

LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)

REFID=57125

$f_2(1950)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M135

 $f_2(1950)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M135PP

NODE=M135PP

NODE=M135PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1830–2020) – i (110–220) OUR ESTIMATE			
$(1955 \pm 75) - i$ (175 ± 57)	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K})$
$(1978.2 \pm 1.8^{+28.4}_{-16.9}) - i$ $(118.8 \pm 0.8^{+20.8}_{-7.8})$	² ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$ $\pi^0K^+K^-$
$(1867 \pm 46) - i$ (193 ± 29)	AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).			
² T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).			

NODE=M135PP;LINKAGE=A

NODE=M135PP;LINKAGE=B

 $f_2(1950)$ MASS

NODE=M135M

NODE=M135M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1936±12 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.			
1940±50	BAI	00A	BES $J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
1980±22	¹ BARBERIS	00C	450 $pp \rightarrow pp4\pi$
1940±22	² BARBERIS	00C	450 $pp \rightarrow pp2\pi2\pi^0$
1960±30	BARBERIS	97B	OMEG $450 pp \rightarrow pp2(\pi^+\pi^-)$
1918±12	ANTINORI	95	OMEG $300,450 pp \rightarrow pp2(\pi^+\pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2038^{+13+12}_{-11-73}	³ UEHARA	09	BELL $10.6 e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1930±25	⁴ BINON	05	GAMS $33 \pi^-p \rightarrow \eta\eta n$
$1980 \pm 2 \pm 14$	ABE	04	BELL $10.6 e^+e^- \rightarrow e^+e^-K^+K^-$
2010±25	ANISOVICH	00J	SPEC
1980±50	ANISOVICH	99B	SPEC $1.35-1.94 p\bar{p} \rightarrow \eta\eta\pi^0$
~ 1990	⁵ OAKDEN	94	RVUE $0.36-1.55 \bar{p}p \rightarrow \pi\pi$
1950±15	⁶ ASTON	91	LASS $11 K^-p \rightarrow \Lambda K\bar{K}\pi\pi$

OCCUR=2

¹ Decaying into $\pi^+\pi^-2\pi^0$.² Decaying into $2(\pi^+\pi^-)$.³ Taking into account $f_4(2050)$.⁴ First solution, PWA is ambiguous.⁵ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J=3$ to be important but not significantly resonant.⁶ Cannot determine spin to be 2.

NODE=M135M;LINKAGE=A4

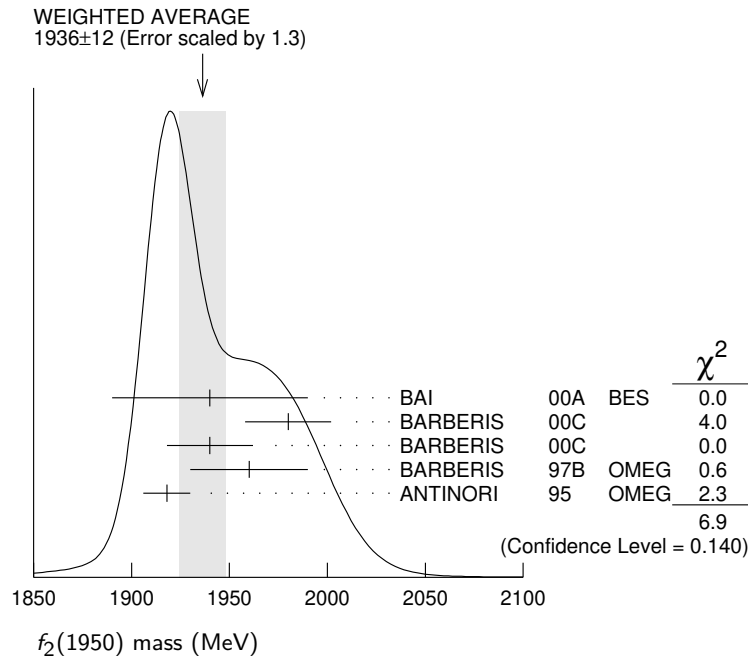
NODE=M135M;LINKAGE=B4

NODE=M135M;LINKAGE=UE

NODE=M135M;LINKAGE=BI

NODE=M135M;LINKAGE=BB

NODE=M135M;LINKAGE=A



$f_2(1950)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
464 ± 24 OUR AVERAGE			
380 ⁺¹²⁰ ₋₉₀	BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
520 ± 50	¹ BARBERIS	00C	450 $pp \rightarrow pp4\pi$
485 ± 55	² BARBERIS	00C	450 $pp \rightarrow pp4\pi$
460 ± 40	BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$
390 ± 60	ANTINORI	95 OMEG	300,450 $pp \rightarrow pp2(\pi^+\pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
441 ⁺²⁷⁺²⁸ ₋₂₅₋₁₉₂	³ UEHARA	09 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
450 ± 50	⁴ BINON	05 GAMS	33 $\pi^-p \rightarrow \eta\eta n$
297 ± 12 ± 6	ABE	04 BELL	10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
495 ± 35	ANISOVICH	00J SPEC	
500 ± 100	ANISOVICH	99B SPEC	1.35–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0$
~ 100	⁵ OAKDEN	94 RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
250 ± 50	⁶ ASTON	91 LASS	11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$

- ¹Decaying into $\pi^+\pi^-\pi^0$.
²Decaying into $2(\pi^+\pi^-)$.
³Taking into account $f_4(2050)$.
⁴First solution, PWA is ambiguous.
⁵From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
⁶Cannot determine spin to be 2.

$f_2(1950)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\bar{K}^*(892)$	seen
Γ_2 $\pi\pi$	
Γ_3 $\pi^+\pi^-$	seen
Γ_4 $\pi^0\pi^0$	seen
Γ_5 4π	seen
Γ_6 $\pi^+\pi^-\pi^+\pi^-$	
Γ_7 $a_2(1320)\pi$	
Γ_8 $\eta\eta$	seen
Γ_9 $K\bar{K}$	seen
Γ_{10} $\gamma\gamma$	seen
Γ_{11} $p\bar{p}$	seen

NODE=M135W

NODE=M135W

OCCUR=2

NODE=M135W;LINKAGE=A4
 NODE=M135W;LINKAGE=B4
 NODE=M135W;LINKAGE=UE
 NODE=M135W;LINKAGE=BI
 NODE=M135W;LINKAGE=BB

NODE=M135W;LINKAGE=A

NODE=M135215;NODE=M135

DESIG=1

DESIG=11

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=10;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=4

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=12

$f_2(1950) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M135225

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_{10} / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

NODE=M135G1
NODE=M135G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$122 \pm 4 \pm 26$	¹ ABE	04	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$

¹ Assuming spin 2.

NODE=M135G1;LINKAGE=AB

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_{10} / \Gamma$

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M135G2
NODE=M135G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

$162^{+69+1137}_{-42-204}$	¹ UEHARA	09	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$

¹ Taking into account $f_4(2050)$.

NODE=M135G2;LINKAGE=UE

 $f_2(1950)$ BRANCHING RATIOS

NODE=M135220

 $\Gamma(K^*(892) \bar{K}^*(892)) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M135R1
NODE=M135R1

seen	ASTON	91	LASS	0	11 $K^- p \rightarrow \Lambda K \bar{K} \pi \pi$

 $\Gamma(a_2(1320) \pi) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M135R3
NODE=M135R3

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

not seen	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$

possibly seen	BARBERIS	97B	OMEG	450 $pp \rightarrow pp2(\pi^+ \pi^-)$

 $\Gamma(\eta\eta) / \Gamma(4\pi)$ Γ_8 / Γ_5

VALUE	CL%	DOCUMENT ID	COMMENT

NODE=M135R5
NODE=M135R5

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 5.0 \times 10^{-3}$	90	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$

 $\Gamma(\eta\eta) / \Gamma(\pi^+ \pi^-)$ Γ_8 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M135R6
NODE=M135R6

0.14 ± 0.05	AMSLER	02	CBAR	0.9 $\bar{p} p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_{11} / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M135R07
NODE=M135R07

seen	111	ALEXANDER	10	CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

 $f_2(1950)$ REFERENCES

NODE=M135

RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
Translated from YAF 68 998.				
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
AMSLER	02	EPJ C23 29	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)
BARBERIS	00B	PL B471 435	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99B	PL B449 154	A.V. Anisovich <i>et al.</i>	
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+) JP
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ASTON	91	NPBPS B21 5	D. Aston <i>et al.</i>	(LASS Collab.)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)

NODE=M135

REFID=61610
REFID=60439
REFID=59455
REFID=56984
REFID=53525
REFID=52761
REFID=50780

REFID=49650
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REFID=46886
REFID=45758
REFID=45212
REFID=44437
REFID=45210
REFID=41746
REFID=20768
REFID=20750
REFID=20355

$a_4(1970)$

$$I^G(J^{PC}) = 1^-(4^{++})$$

NODE=M017

 $a_4(1970)$ MASS

NODE=M017M

NODE=M017M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1967±16 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.					
1935 ⁺¹¹ ₋₁₃	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1900 ⁺⁸⁰ ₋₂₀		ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1985±10±13	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1996±25±43		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$
2000±40 ⁺⁶⁰ ₋₂₀		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
2010±20		² ALDE	96	GAM2	0 38 $\pi^- p \rightarrow \eta \pi^0 n$
2040±30		³ CLELAND	82B	SPEC	± 50 $\pi p \rightarrow K_S^0 K^\pm p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1885±13 ⁺⁵⁰ ₋₂	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
2004±6	80k	⁵ UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
2005 ⁺²⁵ ₋₄₅		⁶ ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
1944±8±50		⁷ AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
1903±10		⁸ BALDI	78	SPEC	- 10 $\pi^- p \rightarrow p K_S^0 K^-$
2030±50		⁹ CORDEN	78C	OMEG	0 15 $\pi^- p \rightarrow 3\pi n$

¹ Statistical error negligible.

² From a simultaneous fit to the G_+ and G_0 wave intensities.

³ From an amplitude analysis.

⁴ Superseded by AGHASYAN 2018B.

⁵ Statistical error only.

⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

⁷ May be a different state.

⁸ From a fit to the Y_8^0 moment. Limited by phase space.

⁹ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

NODE=M017M;LINKAGE=B

NODE=M017M;LINKAGE=A

NODE=M017M;LINKAGE=C

NODE=M017M;LINKAGE=D

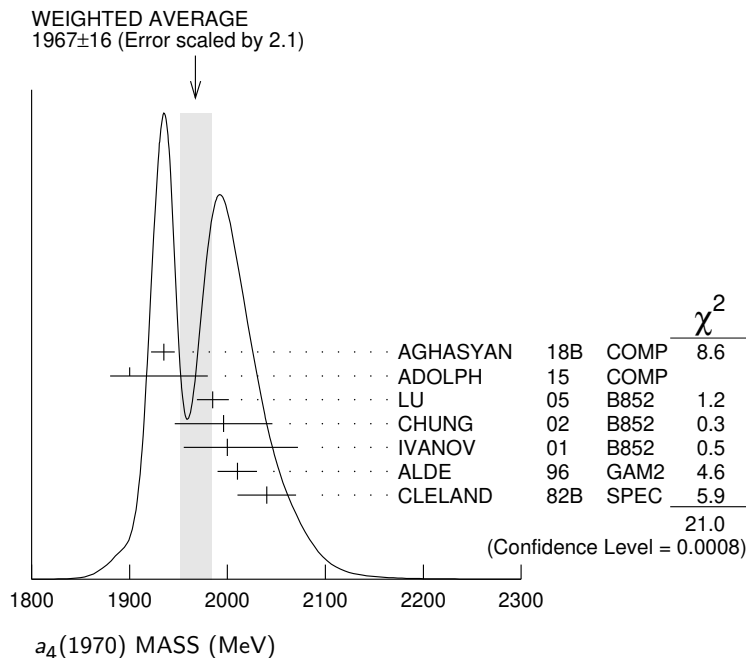
NODE=M017M;LINKAGE=ST

NODE=M017M;LINKAGE=AN

NODE=M017M;LINKAGE=DM

NODE=M017M;LINKAGE=Y

NODE=M017M;LINKAGE=M

 **$a_4(1970)$ WIDTH**

NODE=M017W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M017W

324⁺₋₁₈ OUR AVERAGE

333 ⁺ ₋₂₁	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
300 ⁺ ₋₁₀₀		ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
231 $\pm$ 30 $\pm$ 46	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
298 $\pm$ 81 $\pm$ 85		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$
350 $\pm$ 100 ⁺ ₋₅₀		IVANOV	01	B852	18 $\pi^- p \rightarrow \eta' \pi^- p$
370 $\pm$ 80		² ALDE	96	GAM2 0	38 $\pi^- p \rightarrow \eta \pi^0 n$
380 $\pm$ 150		³ CLELAND	82B	SPEC $\pm$	50 $\pi p \rightarrow K_S^0 K^\pm p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

294 $\pm$ 25 ⁺ ₋₁₉	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ P b'$
401 $\pm$ 16	80k	⁵ UMAN	06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
180 $\pm$ 30		⁶ ANISOVICH	01F	SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
324 $\pm$ 26 $\pm$ 75		⁷ AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
166 $\pm$ 43		⁸ BALDI	78	SPEC $-$	10 $\pi^- p \rightarrow p K_S^0 K^-$
510 $\pm$ 200		⁹ CORDEN	78C	OMEG 0	15 $\pi^- p \rightarrow 3\pi n$

¹ Statistical error negligible.² From a simultaneous fit to the G_+ and G_0 wave intensities.³ From an amplitude analysis.⁴ Superseded by AGHASYAN 2018B.⁵ Statistical error only.⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.⁷ May be a different state.⁸ From a fit to the Y_8^0 moment. Limited by phase space.⁹ $J^P = 4^+$ is favored, though $J^P = 2^+$ cannot be excluded.

NODE=M017W;LINKAGE=B

NODE=M017W;LINKAGE=A

NODE=M017W;LINKAGE=C

NODE=M017W;LINKAGE=D

NODE=M017W;LINKAGE=ST

NODE=M017W;LINKAGE=AN

NODE=M017W;LINKAGE=DM

NODE=M017W;LINKAGE=Y

NODE=M017W;LINKAGE=M

 $a_4(1970)$ DECAY MODES

NODE=M017215;NODE=M017

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \bar{K}$	seen
Γ_2 $\pi^+ \pi^- \pi^0$	seen
Γ_3 $\rho \pi$	seen
Γ_4 $f_2(1270) \pi$	seen
Γ_5 $\omega \pi^- \pi^0$	seen
Γ_6 $\omega \rho$	seen
Γ_7 $\eta \pi$	seen
Γ_8 $\eta'(958) \pi$	seen

DESIG=1

DESIG=2

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=8

DESIG=3

DESIG=4;OUR EST;→ UNCHECKED ←

 $a_4(1970)$ BRANCHING RATIOS

NODE=M017220

$\Gamma(K \bar{K})/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN CHG COMMENT
seen	BALDI 78 SPEC $\pm$ 10 $\pi^- p \rightarrow K_S^0 K^- p$

NODE=M017R1

NODE=M017R1

$\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID TECN CHG COMMENT
seen	CORDEN 78C OMEG 0 15 $\pi^- p \rightarrow 3\pi n$

NODE=M017R2

NODE=M017R2

$\Gamma(\rho \pi)/\Gamma(f_2(1270) \pi)$	Γ_3/Γ_4
VALUE	DOCUMENT ID TECN COMMENT

NODE=M017R4

NODE=M017R4

1.7⁺_{-0.8} OUR AVERAGE Error includes scale factor of 3.7.

2.9 ⁺ _{-0.4}	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1.1 $\pm$ 0.2 $\pm$ 0.2		CHUNG	02	B852	18.3 $\pi^- p \rightarrow 3\pi p$

¹ Statistical error negligible.

NODE=M017R4;LINKAGE=A

$\Gamma(\eta\pi)/\Gamma_{\text{total}}$						Γ_7/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
seen		ALDE	96	GAM2	0	$38 \pi^- p \rightarrow \eta \pi^0 n$
$\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$						Γ_8/Γ_7
VALUE		DOCUMENT ID	TECN		COMMENT	
0.23±0.07		ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$	
$\Gamma(\omega\rho)/\Gamma_{\text{total}}$						Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN		COMMENT	
seen	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$	

NODE=M017R3
NODE=M017R3

NODE=M017R01
NODE=M017R01

NODE=M017R5
NODE=M017R5

a₄(1970) REFERENCES

NODE=M017

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADOLPH	15	PL B740 303	M. Adolph <i>et al.</i>	(COMPASS Collab.)
ALEKSEEV	10	PRL 104 241803	M.G. Alekseev <i>et al.</i>	(COMPASS Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>	
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
AMELIN	99	PAN 62 445	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 62 487.		
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99E	PL B452 187	A.V. Anisovich <i>et al.</i>	
ALDE	96	PAN 59 982	S.V. Donskov <i>et al.</i>	(GAMS Collab.) IGJPC
		Translated from YAF 59 1027.		
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
BALDI	78	PL 74B 413	R. Baldi <i>et al.</i>	(GEVA) JP
CORDEN	78C	NP B136 77	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP

REFID=59471
REFID=56385
REFID=53356
REFID=51063
REFID=50459
REFID=48837
REFID=48352
REFID=48317
REFID=46910

REFID=46903
REFID=46902
REFID=45207

REFID=21281
REFID=21783
REFID=20859

$\rho_3(1990)$

$I^G(J^{PC}) = 1^+(3^{--})$

NODE=M167

OMITTED FROM SUMMARY TABLE

ρ₃(1990) MASS

NODE=M167M

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1982±14		¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 2007		HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.				

NODE=M167M

NODE=M167M;LINKAGE=AY

ρ₃(1990) WIDTH

NODE=M167W

VALUE (MeV)		DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
188±24		² ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
~ 287		HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.				

NODE=M167W

NODE=M167W;LINKAGE=AY

ρ₃(1990) REFERENCES

NODE=M167

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

REFID=48828
REFID=48327
REFID=48349
REFID=47950
REFID=44103

NODE=M239

$\pi_2(2005)$

$I^G(J^{PC}) = 1^-(2^--^+)$

OMITTED FROM SUMMARY TABLE

$\pi_2(2005)$ MASS

NODE=M239M

NODE=M239M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1963^{+17}_{-27} OUR AVERAGE				
1962^{+17}_{-29}	46M	¹ AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$1974 \pm 14 \pm 83$	145k	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2005 ± 15		ANISOVICH	01F SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
¹ Statistical uncertainty negligible.				

NODE=M239M;LINKAGE=A

$\pi_2(2005)$ WIDTH

NODE=M239W

NODE=M239W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
370^{+16}_{-90} OUR AVERAGE				
371^{+16}_{-120}	46M	¹ AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
$341 \pm 61 \pm 139$	145k	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
200 ± 40		ANISOVICH	01F SPEC	2.0 $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
¹ Statistical uncertainty negligible.				

NODE=M239W;LINKAGE=A

$\pi_2(2005)$ DECAY MODES

NODE=M239215;NODE=M239

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^- \pi^+ \pi^-$	seen
$\Gamma_2 \quad \omega \pi^0 \pi^-$	seen

DESIG=1

DESIG=2

$\pi_2(2005)$ BRANCHING RATIOS

NODE=M239220

$\Gamma(\pi^- \pi^+ \pi^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$	
$\Gamma(\omega \pi^0 \pi^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$	

NODE=M239R00

NODE=M239R00

NODE=M239R01

NODE=M239R01

$\pi_2(2005)$ REFERENCES

NODE=M239

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>	

REFID=59471

REFID=50459

REFID=48352

$f_2(2010)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

NODE=M106

 $f_2(2010)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2010$\pm$ 60$\pm$ 80 OUR AVERAGE [2011 $\pm$ 60 $\pm$ 80 MeV OUR 2023 AVERAGE]			
2011$\pm$ 62$\pm$ 76	¹ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2062 $\pm$ 6 $\pm$ 10 $\pm$ 7	² ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
2005 $\pm$ 12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1980 $\pm$ 20	³ BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2050 $\pm$ 90 $\pm$ 50	ETKIN	85 MPS	22 $\pi^- p \rightarrow 2 \phi n$
2120 $\pm$ 20 $\pm$ 120	LINDENBAUM	84 RVUE	
2160 $\pm$ 50	ETKIN	82 MPS	22 $\pi^- p \rightarrow 2 \phi n$

¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 98 $\pm$ 1 $\pm$ 3, 0 $\pm$ 1 $\pm$ 0, and 2 $\pm$ 2 $\pm$ 1, respectively.

² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

³ Statistically very weak, only 1.4 s.d.

NODE=M106M

NODE=M106M

NEW

NODE=M106M;LINKAGE=C

NODE=M106M;LINKAGE=A

NODE=M106M;LINKAGE=E

 $f_2(2010)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
200$\pm$ 60 OUR AVERAGE [202 $\pm$ 60 MeV OUR 2023 AVERAGE]			
202$\pm$ 67$\pm$ 62	⁴ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
165 $\pm$ 17 $\pm$ 10 $\pm$ 5	⁵ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
209 $\pm$ 32	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
145 $\pm$ 50	⁶ BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
200 $\pm$ 160 $\pm$ 50	ETKIN	85 MPS	22 $\pi^- p \rightarrow 2 \phi n$
300 $\pm$ 150 $\pm$ 50	LINDENBAUM	84 RVUE	
310 $\pm$ 70	ETKIN	82 MPS	22 $\pi^- p \rightarrow 2 \phi n$

⁴ Includes data of ETKIN 85.

⁵ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

⁶ Statistically very weak, only 1.4 s.d.

NODE=M106W

NODE=M106W

NEW

NODE=M106W;LINKAGE=C

NODE=M106W;LINKAGE=A

NODE=M106W;LINKAGE=E

 $f_2(2010)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\phi \phi$	seen
Γ_2 $K \bar{K}$	seen

NODE=M106215;NODE=M106

DESIG=1;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
DESIG=2

 $f_2(2010)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	Γ_2/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$

NODE=M106230

NODE=M106R01

NODE=M106R01

 $f_2(2010)$ REFERENCES

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
VLADIMIRSK...06		PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
		Translated from YAF 69 515.		
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)
ETKIN	82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)
Also		Brighton Conf. 351	S.J. Lindenbaum	(BNL, CUNY)

NODE=M106

REFID=61891

REFID=62033

REFID=51191

REFID=40580

REFID=40285

REFID=21871

REFID=21869

REFID=21866

REFID=21867

$f_0(2020)$

Needs confirmation.

$$I^G(J^{PC}) = 0^+(0^{++})$$

NODE=M156

NODE=M156

NODE=M156PP

NODE=M156PP

NODE=M156PP

→ UNCHECKED ←

NODE=M156PP;LINKAGE=A

NODE=M156PP;LINKAGE=C

NODE=M156PP;LINKAGE=B

NODE=M156M

NODE=M156M

NODE=M156M;LINKAGE=C

NODE=M156M;LINKAGE=D

NODE=M156M;LINKAGE=ST

NODE=M156W

NODE=M156W

NEW

NODE=M156W;LINKAGE=C

NODE=M156W;LINKAGE=D

NODE=M156W;LINKAGE=ST

 $f_0(2020)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1870–2080) – i (120–240) OUR ESTIMATE			
$(2038 \pm 48) - i (156 \pm 41)$	¹ RODAS	22	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K})$
$(1925 \pm 25) - i (160 \pm 18)$	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$(1910 \pm 50) - i (199 \pm 40)$	² ROPERTZ	18	RVUE $\bar{B}_s^0 \rightarrow J/\psi(\pi^+\pi^-/K^+K^-)$
$(1992 \pm 16) - i (221 \pm 30)$	³ BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
$(2020 \pm 35) - i (205 \pm 25)$	BARBERIS	97B	OMEG 450 $pp \rightarrow pp2(\pi^+\pi^-)$
¹ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma\pi^0\pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).			
² T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.			
³ Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.			

 $f_0(2020)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1982 \pm 3^{+54}_{-0}$		¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma2(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2010 \pm 6^{+6}_{-4}$		² ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
2037 ± 8	80k	³ UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
2040 ± 38		ANISOVICH	00J	SPEC
2010 ± 60		ALDE	98	GAM4 $100 \pi^- p \rightarrow \pi^0\pi^0 n$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.				
² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta' P$ -wave.				
³ Statistical error only.				

 $f_0(2020)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
440 ± 50 OUR AVERAGE		[436 $\pm$ 50 MeV OUR 2023 AVERAGE]		
$436 \pm 4^{+46}_{-49}$		¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma2(\pi^+\pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$203 \pm 9^{+13}_{-11}$		² ABLIKIM	22AS	BES3 $J/\psi(1S) \rightarrow \gamma\eta\eta'$
296 ± 17	80k	³ UMAN	06	E835 $5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
405 ± 40		ANISOVICH	00J	SPEC
240 ± 100		ALDE	98	GAM4 $100 \pi^- p \rightarrow \pi^0\pi^0 n$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta'\eta'$, and $(\eta' X)$, with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.				
² From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta\eta' P$ -wave.				
³ Statistical error only.				

f₀(2020) DECAY MODES

Mode		Fraction (Γ_i/Γ)
Γ_1	$\rho\pi\pi$	seen
Γ_2	$\pi^0\pi^0$	seen
Γ_3	$\rho\rho$	seen
Γ_4	$\omega\omega$	seen
Γ_5	$\eta\eta$	seen
Γ_6	$\eta'\eta'$	seen

NODE=M156215;NODE=M156

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=5
DESIG=6

f₀(2020) BRANCHING RATIOS

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$		Γ_3/Γ_4
VALUE	DOCUMENT ID	COMMENT

NODE=M156R1
NODE=M156R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 3 BARBERIS 00F 450 $p p \rightarrow p_f \omega \omega p_s$

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$				Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	

NODE=M156R01
NODE=M156R01

seen UMAN 06 E835 5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$

$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$				Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	

NODE=M156R00
NODE=M156R00

seen ¹ ABLIKIM 22C BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

¹ From a partial wave analysis of the systems (γX), with $X \rightarrow \eta' \eta'$, and ($\eta' X$), with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M156R00;LINKAGE=A

f₀(2020) REFERENCES

NODE=M156

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ROPERTZ	18	EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)
AAIJ	17V	JHEP 1708 037	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	14BR	PR D89 092006	R. Aaij <i>et al.</i>	(LHCb Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)

REFID=61891
REFID=62033
REFID=61637
REFID=61610
REFID=61091
REFID=59455
REFID=59332
REFID=57828
REFID=56984
REFID=56035
REFID=51063
REFID=47950
REFID=47959
REFID=47962
REFID=46605
REFID=46914
REFID=45758

$f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

NODE=M016

 $f_4(2050)$ MASS

NODE=M016M

NODE=M016M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2018±11 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
1960±15		AMELIN	06 VES	36 $\pi^- p \rightarrow \omega \omega n$
2005±10		¹ BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
1998±15		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2060±20		ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega \omega n$
2038±30		AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2086±15		BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
2000±60		ALDE	86D GAM4	100 $\pi^- p \rightarrow n 2\eta$
2020±20	40k	² BINON	84B GAM2	38 $\pi^- p \rightarrow n 2\pi^0$
2015±28		³ CASON	82 STRC	8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
2031 ⁺²⁵ ₋₃₆		ETKIN	82B MPS	23 $\pi^- p \rightarrow n 2K_S^0$
2020±30	700	APEL	75 NICE	40 $\pi^- p \rightarrow n 2\pi^0$
2050±25		BLUM	75 ASPK	18.4 $\pi^- p \rightarrow n K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1966±25		⁴ ANISOVICH	09 RVUE	0.0 $\bar{p} p, \pi N$
1885 ⁺¹⁴⁺²¹⁸ ₋₁₃₋₂₅		⁵ UEHARA	09 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
2018± 6		ANISOVICH	00J SPEC	2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 2000		⁶ MARTIN	98 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2010		⁷ MARTIN	97 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 2040		⁸ OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 1990		⁹ OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
1978± 5		¹⁰ ALPER	80 CNTR	62 $\pi^- p \rightarrow K^+ K^- n$
2040±10		¹⁰ ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p \bar{p} n$
1935±13		¹⁰ CORDEN	79 OMEG	12-15 $\pi^- p \rightarrow n 2\pi$
1988± 7		EVANGELIS...	79B OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
1922±14		¹¹ ANTIPOV	77 CIBS	25 $\pi^- p \rightarrow p 3\pi$

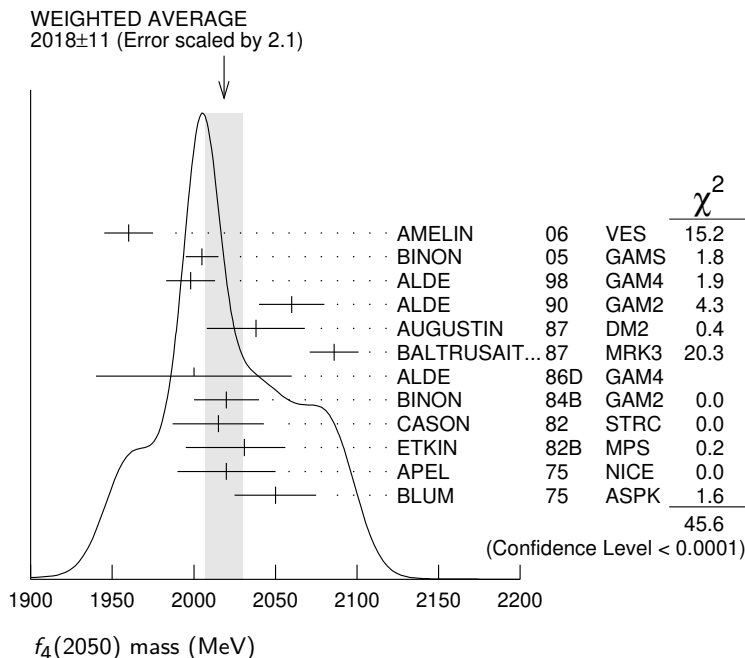
¹ From the first PWA solution.² From a partial-wave analysis of the data.³ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2\pi^0$.⁴ K matrix pole.⁵ Taking into account the $f_2(1950)$. Helicity-2 production favored.⁶ Energy-dependent analysis.⁷ Single energy analysis.⁸ From solution A of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.⁹ From solution B of amplitude analysis of data on $\bar{p} p \rightarrow \pi \pi$. See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.¹¹ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

OCCUR=2

NODE=M016M;LINKAGE=BI
 NODE=M016M;LINKAGE=N
 NODE=M016M;LINKAGE=NN
 NODE=M016M;LINKAGE=KM
 NODE=M016M;LINKAGE=UE
 NODE=M016M;LINKAGE=RB
 NODE=M016M;LINKAGE=BR
 NODE=M016M;LINKAGE=B

NODE=M016M;LINKAGE=BB

NODE=M016M;LINKAGE=M
 NODE=M016M;LINKAGE=T



$f_4(2050)$ WIDTH

NODE=M016W

NODE=M016W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
237± 18 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
290± 20		AMELIN	06 VES	36 $\pi^- p \rightarrow \omega \omega n$
340± 80		12 BINON	05 GAMS	33 $\pi^- p \rightarrow \eta \eta n$
395± 40		ALDE	98 GAM4	100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
170± 60		ALDE	90 GAM2	38 $\pi^- p \rightarrow \omega \omega n$
304± 60		AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
210± 63		BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
400±100		ALDE	86D GAM4	100 $\pi^- p \rightarrow n 2 \eta$
240± 40	40k	13 BINON	84B GAM2	38 $\pi^- p \rightarrow n 2 \pi^0$
190± 14		DENNEY	83 LASS	10 $\pi^+ n / \pi^+ p$
186 ⁺¹⁰³ ₋₅₈		14 CASON	82 STRC	8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$
305 ⁺³⁶ ₋₁₁₉		ETKIN	82B MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
180± 60	700	APEL	75 NICE	40 $\pi^- p \rightarrow n 2 \pi^0$
225 ⁺¹²⁰ ₋₇₀		BLUM	75 ASPK	18.4 $\pi^- p \rightarrow n K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

260± 40	15	ANISOVICH	09 RVUE	0.0 $\bar{p} p, \pi N$
453± 20 ⁺³¹ ₋₁₂₉	16	UEHARA	09 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
182± 7		ANISOVICH	00J SPEC	2.0 $\bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0,$ $\eta \eta, \eta \eta', \pi \pi$
~ 170	17	MARTIN	98 RVUE	$N \bar{N} \rightarrow \pi \pi$
~ 200	18	MARTIN	97 RVUE	$\bar{N} N \rightarrow \pi \pi$
~ 60	19	OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
~ 80	20	OAKDEN	94 RVUE	0.36-1.55 $\bar{p} p \rightarrow \pi \pi$
243± 16	21	ALPER	80 CNTR	62 $\pi^- p \rightarrow K^+ K^- n$
140± 15	21	ROZANSKA	80 SPRK	18 $\pi^- p \rightarrow p \bar{p} n$
263± 57	21	CORDEN	79 OMEG	12-15 $\pi^- p \rightarrow n 2 \pi$
100± 28		EVANGELIS...	79B OMEG	10 $\pi^- p \rightarrow K^+ K^- n$
107± 56	22	ANTIPOV	77 CIBS	25 $\pi^- p \rightarrow p 3 \pi$

12 From the first PWA solution.

13 From a partial-wave analysis of the data.

14 From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.

15 K matrix pole.

16 Taking into account the $f_2(1950)$. Helicity-2 production favored.

17 Energy-dependent analysis.

18 Single energy analysis.

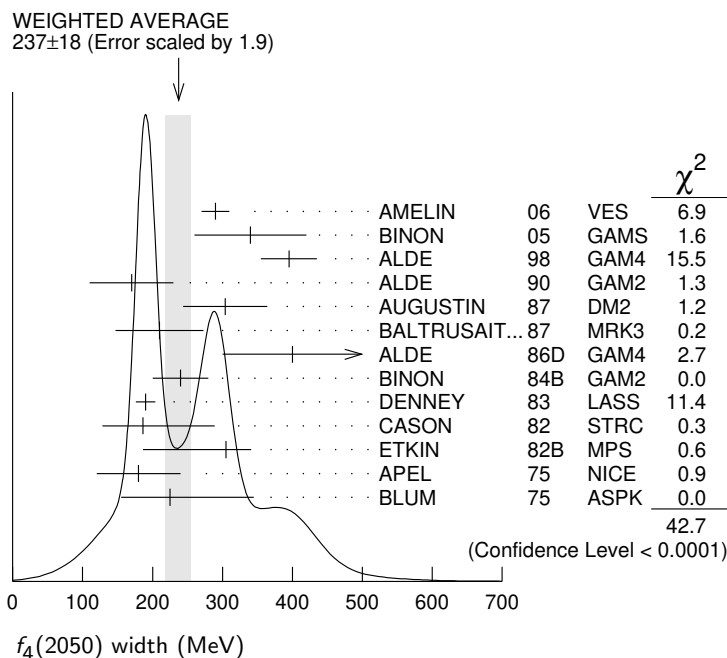
OCCUR=2

NODE=M016W;LINKAGE=BI
 NODE=M016W;LINKAGE=N
 NODE=M016W;LINKAGE=NN
 NODE=M016W;LINKAGE=KM
 NODE=M016W;LINKAGE=UE
 NODE=M016W;LINKAGE=RB
 NODE=M016W;LINKAGE=BR

- 19 From solution A of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 20 From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$. See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.
- 21 $I(J^P) = 0(4^+)$ from amplitude analysis assuming one-pion exchange.
- 22 Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

NODE=M016W;LINKAGE=BW

NODE=M016W;LINKAGE=BB

NODE=M016W;LINKAGE=M
NODE=M016W;LINKAGE=T **$f_4(2050)$ DECAY MODES**

NODE=M016215;NODE=M016

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \omega\omega$	seen
$\Gamma_2 \quad \pi\pi$	(17.0±1.5) %
$\Gamma_3 \quad K\bar{K}$	(6.8 ^{+3.4} _{-1.8}) × 10 ⁻³
$\Gamma_4 \quad \eta\eta$	(2.1±0.8) × 10 ⁻³
$\Gamma_5 \quad 4\pi^0$	< 1.2 %
$\Gamma_6 \quad \gamma\gamma$	seen
$\Gamma_7 \quad a_2(1320)\pi$	seen

DESIG=6

DESIG=1

DESIG=2

DESIG=3

DESIG=5

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=7

 $f_4(2050) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M016220

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_6/\Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.29 95 ALTHOFF 85B TASS $\gamma\gamma \rightarrow K\bar{K}\pi$	

NODE=M016G2

NODE=M016G2

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_6/\Gamma$
VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
23.1 ^{+3.6} _{-3.3} + 70.5 _{-15.6} 23 UEHARA 09 BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	
<1100 95 13 ± 4 OEST 90 JADE $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	

23 Taking into account the $f_2(1950)$. Helicity-2 production favored.

NODE=M016G3

NODE=M016G3

NODE=M016G3;LINKAGE=UE

 $f_4(2050)$ BRANCHING RATIOS

NODE=M016225

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen AMELIN 06 VES 36 $\pi^-p \rightarrow \omega\omega n$	
• • • We do not use the following data for averages, fits, limits, etc. • • •	
not seen BARBERIS 00F 450 $pp \rightarrow pf\omega\omega p_S$	

NODE=M016R7

NODE=M016R7

$\Gamma(\omega\omega)/\Gamma(\pi\pi)$

VALUE

1.5±0.3

DOCUMENT ID

ALDE

TECN

90

COMMENT

38 $\pi^- p \rightarrow \omega\omega n$ Γ_1/Γ_2

NODE=M016R5

NODE=M016R5

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$

VALUE

0.170±0.015 OUR AVERAGE

0.18 ±0.03

0.16 ±0.03

0.17 ±0.02

²⁴ Assuming one pion exchange.

DOCUMENT ID

²⁴ BINON

83C

GAM2

38 $\pi^- p \rightarrow n4\gamma$ ²⁴ CASON

82

STRC

8 $\pi^+ p \rightarrow \Delta^{++}\pi^0$ ²⁴ CORDEN

79

OMEG

12-15 $\pi^- p \rightarrow n2\pi$ Γ_2/Γ

NODE=M016R1

NODE=M016R1

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$

VALUE

0.04^{+0.02}_{-0.01}

DOCUMENT ID

ETKIN

TECN

82B

COMMENT

23 $\pi^- p \rightarrow n2K_S^0$ Γ_3/Γ_2

NODE=M016R2

NODE=M016R2

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ VALUE (units 10⁻³)**2.1±0.8**

DOCUMENT ID

ALDE

TECN

86D

COMMENT

100 $\pi^- p \rightarrow n4\gamma$ Γ_4/Γ

NODE=M016R3

NODE=M016R3

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$

VALUE

<0.012

DOCUMENT ID

ALDE

TECN

87

COMMENT

100 $\pi^- p \rightarrow 4\pi^0 n$ Γ_5/Γ

NODE=M016R4

NODE=M016R4

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE

seen

DOCUMENT ID

AMELIN

TECN

00

COMMENT

37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$ Γ_7/Γ

NODE=M016R6

NODE=M016R6

f₄(2050) REFERENCES

NODE=M016

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(PNPI)	REFID=52719
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=51574
Translated from YAF 69 715.					
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
Translated from YAF 68 998.					
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47962
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)	REFID=46605
Also					
		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=46914
Translated from YAF 62 446.					
MARTIN	98	PR C57 3492	B.R. Martin <i>et al.</i>		REFID=46373
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)	REFID=45685
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=40935
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)	REFID=21780
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)	REFID=40288
Translated from YAF 38 1199.					
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20746
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21665
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	REFID=21774
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20374
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21967
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)	REFID=20720
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM)	REFID=21651

$\pi_2(2100)$

$I^G(J^{PC}) = 1^-(2^-+)$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$\pi_2(2100)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2090± 29 OUR AVERAGE			
2090± 30	¹ AMELIN	95B VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
2100± 150	² DAUM	81B CNTR	$63,94 \pi^- p \rightarrow 3\pi X$
¹ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
² From a two-resonance fit to four 2^-0^+ waves.			

$\pi_2(2100)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
620± 50 OUR AVERAGE Error includes scale factor of 1.2. [625 ± 50 MeV OUR 2023 AVERAGE Scale factor = 1.2]			
520± 100	³ AMELIN	95B VES	$36 \pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
651± 50	⁴ DAUM	81B CNTR	$63,94 \pi^- p \rightarrow 3\pi X$
³ From a fit to $J^{PC} = 2^-+ f_2(1270)\pi, (\pi\pi)_S\pi$ waves.			
⁴ From a two-resonance fit to four 2^-0^+ waves.			

$\pi_2(2100)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad 3\pi$	seen
$\Gamma_2 \quad \rho\pi$	seen
$\Gamma_3 \quad f_2(1270)\pi$	seen
$\Gamma_4 \quad (\pi\pi)_S\pi$	seen

$\pi_2(2100)$ BRANCHING RATIOS

$\Gamma(\rho\pi)/\Gamma(3\pi)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.19±0.05	⁵ DAUM 81B CNTR $63,94 \pi^- p$
$\Gamma(f_2(1270)\pi)/\Gamma(3\pi)$	Γ_3/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.36±0.09	⁵ DAUM 81B CNTR $63,94 \pi^- p$
$\Gamma((\pi\pi)_S\pi)/\Gamma(3\pi)$	Γ_4/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
0.45±0.07	⁵ DAUM 81B CNTR $63,94 \pi^- p$
D-wave/S-wave RATIO FOR $\pi_2(2100) \rightarrow f_2(1270)\pi$	
VALUE	DOCUMENT ID TECN COMMENT
0.39±0.23	⁵ DAUM 81B CNTR $63,94 \pi^- p$
⁵ From a two-resonance fit to four 2^-0^+ waves.	

$\pi_2(2100)$ REFERENCES

AMELIN	95B	PL B356 595	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
DAUM	81B	NP B182 269	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M020

NODE=M020

NODE=M020M

NODE=M020M

NODE=M020M;LINKAGE=AX
NODE=M020M;LINKAGE=L

NODE=M020W

NODE=M020W
NEW

NODE=M020W;LINKAGE=AX
NODE=M020W;LINKAGE=L

NODE=M020215;NODE=M020

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

NODE=M020220

NODE=M020R1
NODE=M020R1

NODE=M020R2
NODE=M020R2

NODE=M020R3
NODE=M020R3

NODE=M020R4
NODE=M020R4

NODE=M020R;LINKAGE=L

NODE=M020

REFID=44433
REFID=20872

$f_0(2100)$

$$I^G(J^{PC}) = 0^{++}(0^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M168

NODE=M168

NODE=M168M

NODE=M168M

 $f_0(2100)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2095^{+17}_{-19} OUR AVERAGE				
$2116 \pm 27 \pm 17$		LEES	21A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
$2081 \pm 13^{+24}_{-36}$	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2090 ± 30		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2075 ± 20		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$2090 \pm 10 \pm 6$	529	^{2,3} DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
$2099 \pm 17 \pm 8$	283	^{2,3} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
2105 ± 8	80k	⁴ UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
2102 ± 13		⁵ ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0, \eta \eta, \eta \eta', \pi^+ \pi^-$
2105 ± 10		ANISOVICH	99K SPEC	$0.6-1.94 \bar{p} p \rightarrow \eta \eta, \eta \eta'$
~ 2104		BUGG	95	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
~ 2122		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Using CLEO-c data but not authored by the CLEO Collaboration.

³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 209$ MeV.

⁴ Statistical error only.

⁵ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

OCCUR=2

NODE=M168M;LINKAGE=A

NODE=M168M;LINKAGE=B

NODE=M168M;LINKAGE=C

NODE=M168M;LINKAGE=ST

NODE=M168M;LINKAGE=AN

 $f_0(2100)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
287^{+32}_{-24} OUR AVERAGE				
$289 \pm 34 \pm 15$		LEES	21A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' \pi^+ \pi^-$
$273^{+27}_{-24} \pm 70_{-23}$	5.5k	¹ ABLIKIM	13N BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
330 ± 100		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^+ \pi^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
260 ± 25		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
236 ± 14	80k	² UMAN	06 E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
211 ± 29		³ ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \eta \pi^0 \pi^0, \pi^0 \pi^0, \eta \eta, \eta \eta', \pi^+ \pi^-$
200 ± 25		ANISOVICH	99K SPEC	$0.6-1.94 \bar{p} p \rightarrow \eta \eta, \eta \eta'$
~ 203		BUGG	95	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$
~ 273		HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

² Statistical error only.

³ Includes the data of ANISOVICH 00B indicating to exotic decay pattern.

NODE=M168W

NODE=M168W

NODE=M168W;LINKAGE=A

NODE=M168W;LINKAGE=ST

NODE=M168W;LINKAGE=AN

 $f_0(2100)$ REFERENCES

LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BAI	00A	PL B472 207	J.Z. Bai <i>et al.</i>	(BES Collab.)
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M168

REFID=61442

REFID=61091

REFID=56805

REFID=55387

REFID=51063

REFID=47942

REFID=47950

REFID=47426

REFID=47472

REFID=44438

REFID=44103

$f_2(2150)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called T_0 .

NODE=M042

NODE=M042

NODE=M042205

NODE=M042M
NODE=M042M

NODE=M042M;LINKAGE=ST

NODE=M042M3
NODE=M042M3NODE=M042M3;LINKAGE=K3
NODE=M042M3;LINKAGE=ANODE=M042M4
NODE=M042M4

NODE=M042M4;LINKAGE=AD

NODE=M042M1
NODE=M042M1

OCCUR=2

NODE=M042M1;LINKAGE=B

NODE=M042M1;LINKAGE=BB
NODE=M042M1;LINKAGE=P
NODE=M042M1;LINKAGE=LNODE=M042M2
NODE=M042M2NODE=M042M2;LINKAGE=I
NODE=M042M2;LINKAGE=E
NODE=M042M2;LINKAGE=M **$f_2(2150)$ MASS** **$f_2(2150)$ MASS, COMBINED MODES (MeV)**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

2157±12 OUR AVERAGE Includes data from the datablock that follows this one.

• • • We do not use the following data for averages, fits, limits, etc. • • •

2170±6 80k ¹ UMAN 06 E835 5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$ ¹ Statistical error only. **$\eta\eta$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

2157±12 OUR AVERAGE

2151±16	BARBERIS	00E	450 $pp \rightarrow pf\eta\eta p_S$
2175±20	PROKOSHKIN	95D	GAM4 300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$
2130±35	SINGOVSKI	94	GAM4 450 $pp \rightarrow pp 2\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2140±30 ² ABELE 99B CBAR 1.94 $\bar{p}p \rightarrow \pi^0\eta\eta$ 2104±20 ³ ARMSTRONG 93C E760 $\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$ ² Spin not determined.³ No J^{PC} determination. **$\eta\pi\pi$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2135±20±45 ⁴ ADOMEIT 96 CBAR 0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$ ⁴ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance. **$\bar{p}p \rightarrow \pi\pi$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2090 ⁵ OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$ ~ 2120 ⁶ OAKDEN 94 RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$ ~ 2170 ⁷ MARTIN 80B RVUE~ 2150 ⁷ MARTIN 80C RVUE~ 2150 ⁸ DULUDE 78B OSPK 1–2 $\bar{p}p \rightarrow \pi^0\pi^0$ ⁵ OAKDEN 94 makes an amplitude analysis of LEAR data on $\bar{p}p \rightarrow \pi\pi$ using a method based on Barrelet zeros. This is solution A. The amplitude analysis of HASAN 94 includes earlier data as well, and assume that the data can be parametrized in terms of towers of nearly degenerate resonances on the leading Regge trajectory. See also KLOET 96 and MARTIN 97 who make related analyses.⁶ From solution B of amplitude analysis of data on $\bar{p}p \rightarrow \pi\pi$.⁷ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.⁸ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.**S-CHANNEL $\bar{p}p$, $\bar{N}N$ or $\bar{K}K$**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2139⁺⁸₋₉ ⁹ EVANGELIS... 97 SPEC 0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$ ~ 2190 ⁹ CUTTS 78B CNTR 0.97–3 $\bar{p}p \rightarrow \bar{N}N$ 2155±15 ^{9,10} COUPLAND 77 CNTR 0 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$ 2193±2 ^{9,11} ALSPECTOR 73 CNTR $\bar{p}p$ S channel⁹ Isospins 0 and 1 not separated.¹⁰ From a fit to the total elastic cross section.¹¹ Referred to as T or T region by ALSPECTOR 73.

K K̄ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2200 ± 13	VLADIMIRSK...06	SPEC	40 π ⁻ p → K _S ⁰ K _S ⁰ n
2150 ± 20	ABLIKIM	04E	BES2 J/ψ → ω K ⁺ K ⁻
2130 ± 35	BARBERIS	99	OMEG 450 p p → p _s p _f K ⁺ K ⁻

NODE=M042M5
NODE=M042M5

f₂(2150) WIDTH

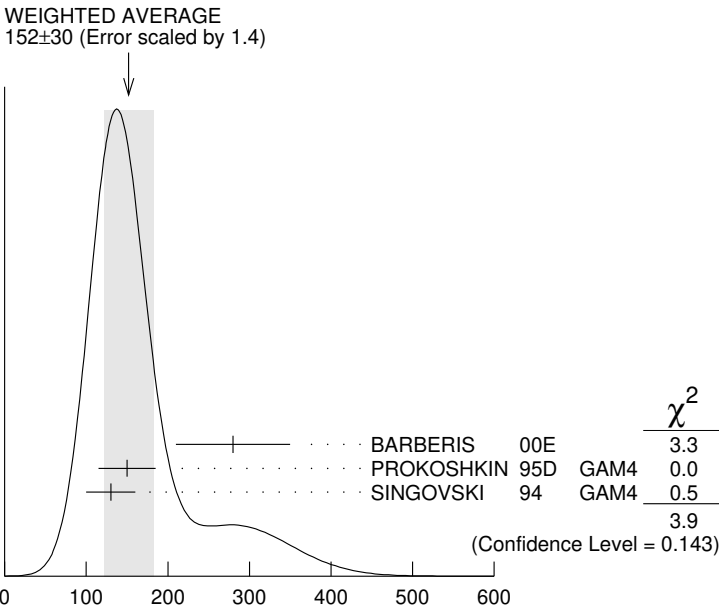
NODE=M042210

f₂(2150) WIDTH, COMBINED MODES (MeV)

NODE=M042W
NODE=M042W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
152 ± 30 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.4. See the ideogram below.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
182 ± 11	80k	¹² UMAN	06	E835 5.2 p̄ p → η η π ⁰
¹² Statistical error only.				

NODE=M042W;LINKAGE=ST



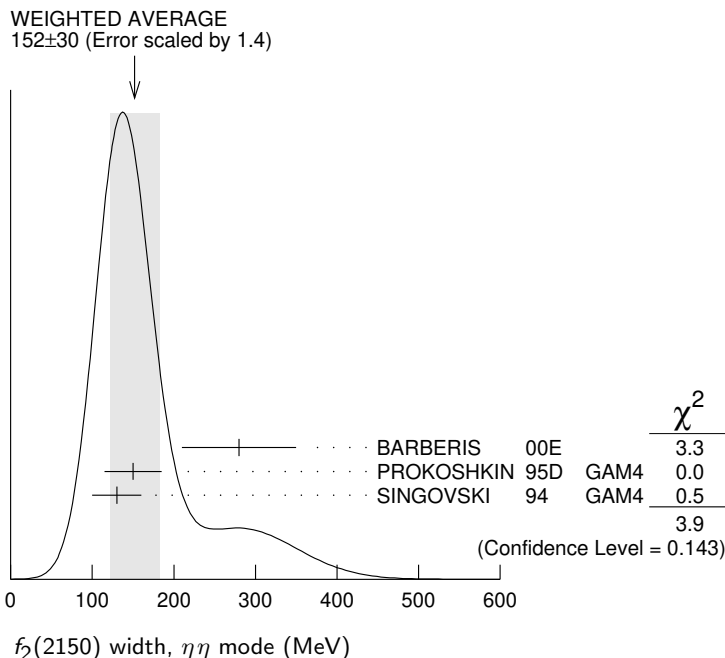
f₂(2150) width, combined modes (MeV)

η η MODE

NODE=M042W3
NODE=M042W3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
The data in this block is included in the average printed for a previous datablock.			
152 ± 30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.			
280 ± 70	BARBERIS	00E	450 p p → p _f η η p _s
150 ± 35	PROKOSHKIN	95D	GAM4 300 π ⁻ N → π ⁻ N 2 η, 450 p p → p p 2 η
130 ± 30	SINGOVSKI	94	GAM4 450 p p → p p 2 η
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310 ± 50	¹³ ABELE	99B	CBAR 1.94 p̄ p → π ⁰ η η
203 ± 10	¹⁴ ARMSTRONG	93C	E760 p̄ p → π ⁰ η η → 6 γ
¹³ Spin not determined.			
¹⁴ No J ^{PC} determination.			

NODE=M042W3;LINKAGE=K3
NODE=M042W3;LINKAGE=A



$\eta\pi\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
250±25±45	¹⁵ ADOMEIT	96	CBAR	0 1.94 $\bar{p}p \rightarrow \eta 3\pi^0$
¹⁵ ANISOVICH 00E recommends to withdraw ADOMEIT 96 that assumed a single $J^P = 2^+$ resonance.				

NODE=M042W4
NODE=M042W4

NODE=M042W4;LINKAGE=AD

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
250 OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 70	¹⁶ OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	¹⁷ MARTIN	80B	RVUE
~ 250	¹⁷ MARTIN	80C	RVUE
~ 250	¹⁸ DULUDE	78B	OSPK 1–2 $\bar{p}p \rightarrow \pi^0\pi^0$
¹⁶ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.			
¹⁷ $I(J^P) = 0(2^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.			
¹⁸ $I^G(J^P) = 0^+(2^+)$ from partial-wave amplitude analysis.			

NODE=M042W1
NODE=M042W1
→ UNCHECKED ←

NODE=M042W1;LINKAGE=CC

NODE=M042W1;LINKAGE=P
NODE=M042W1;LINKAGE=L

S-CHANNEL $\bar{p}p$, $\bar{N}N$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
56 ⁺³¹ ₋₁₆	¹⁹ EVANGELIS...	97	SPEC	0.6–2.4 $\bar{p}p \rightarrow K_S^0 K_S^0$
135±75	^{20,21} COUPLAND	77	CNTR	0 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98±8	²¹ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
¹⁹ Isospin 0 and 2 not separated.				
²⁰ From a fit to the total elastic cross section.				
²¹ Isospins 0 and 1 not separated.				

NODE=M042W2
NODE=M042W2

NODE=M042W2;LINKAGE=F
NODE=M042W2;LINKAGE=E
NODE=M042W2;LINKAGE=I

$K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
91±62	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
150±30	ABLIKIM	04E	BES2 $J/\psi \rightarrow \omega K^+ K^-$
270±50	BARBERIS	99	OMEG 450 $p\bar{p} \rightarrow p_S p_f K^+ K^-$

NODE=M042W5
NODE=M042W5

$f_2(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	
Γ_2 $\eta\eta$	seen
Γ_3 $K\bar{K}$	seen
Γ_4 $f_2(1270)\eta$	seen
Γ_5 $a_2(1320)\pi$	seen
Γ_6 $\rho\bar{\rho}$	seen

NODE=M042215;NODE=M042

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6

 $f_2(2150)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma(\eta\eta)$ **Γ_3/Γ_2**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
1.28 ± 0.23		BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.1	95	²² PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$

²² Using data from ARMSTRONG 89D.

NODE=M042220

NODE=M042R1

NODE=M042R1

NODE=M042R1;LINKAGE=A

$\Gamma(\pi\pi)/\Gamma(\eta\eta)$ **Γ_1/Γ_2**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.33	95	²³ PROKOSHKIN 95D	GAM4	300 $\pi^- N \rightarrow \pi^- N 2\eta$, 450 $pp \rightarrow pp 2\eta$

²³ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R2

NODE=M042R2

NODE=M042R2;LINKAGE=A

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$ **Γ_4/Γ_5**

VALUE	DOCUMENT ID	TECN	COMMENT
0.79 ± 0.11	²⁴ ADOMEIT 96	CBAR	1.94 $\bar{p}p \rightarrow \eta 3\pi^0$

²⁴ Using $B(a_2(1320) \rightarrow \eta\pi) = 0.145$

NODE=M042R3

NODE=M042R3

NODE=M042R3;LINKAGE=A

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ **Γ_6/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma \rho\bar{\rho}$

NODE=M042R04

NODE=M042R04

 $f_2(2150)$ REFERENCES

ALEXANDER 10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
UMAN 06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
	Translated from YAF 69 515.		
ABLIKIM 04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
BARBERIS 00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ABELE 99B	EPJ C8 67	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)
BARBERIS 99	PL B453 305	D. Barberis <i>et al.</i>	(Omega Expt.)
EVANGELIS... 97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
MARTIN 97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
KLOET 96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
PROKOSHKIN 95D	PD 40 495	Y.D. Prokoshkin	(SERP) IGJPC
	Translated from DANS 344 469.		
HASAN 94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN 94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
SINGOVSKI 94	NC A107 1911	A.V. Singovsky	(SERP)
ARMSTRONG 93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ARMSTRONG 89D	PL B227 186	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
MARTIN 80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN 80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS 78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE 78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
COUPLAND 77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR 73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)

NODE=M042

REFID=53525

REFID=51063

REFID=51191

REFID=50174

REFID=47945

REFID=47961

REFID=46904

REFID=46921

REFID=45687

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REFID=44103

REFID=45210

REFID=44648

REFID=43587

REFID=41010

REFID=21838

REFID=21837

REFID=21733

REFID=21850

REFID=21830

REFID=21813

$\rho(2150)$

$$I^G(J^{PC}) = 1^+(1^-)$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $T_1(2190)$. See the review on "Spectroscopy of Light Meson Resonances."

NODE=M032

NODE=M032

NODE=M032205

NODE=M032M3

NODE=M032M3

 $\rho(2150)$ MASS **e^+e^- PRODUCED**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2044 ± 31 ± 4		¹ ABLIKIM	23BQ BES3	$e^+e^- \rightarrow a_2(1320)^+\pi^- +$ c.c. $\rightarrow \eta\pi^+\pi^-$
2095 ± 4		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
2034 ± 13 ± 9		³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega\pi^0$
2111 ± 43 ± 25		⁴ ABLIKIM	21X BES3	$e^+e^- \rightarrow \eta'\pi^+\pi^-$
2255 $+17$ $+50$ -18 -41	1.8k	⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+K^-\eta$
2201 ± 19		⁶ LEES	20 BABR	$e^+e^- \rightarrow K^+K^-\gamma$
2227 ± 9 ± 9		⁷ LEES	20 RVUE	$e^+e^- \rightarrow K^+K^-$
2039 ± 8 $+36$ -18		⁸ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+K^-\pi^0$
2239.2 $\pm 7.1 \pm 11.3$		⁹ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+K^-$
2254 ± 22		¹⁰ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
2150 ± 40 ± 50		AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow$ $f_1(1285)\pi^+\pi^-\gamma$
1990 ± 80		AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
2153 ± 37		BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
2110 ± 50		¹¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-),$ $2(\pi^+\pi^-\pi^0)$

OCCUR=2

OCCUR=2

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of a Breit-Wigner resonance and a non-resonant contribution. Could be another state.

² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. Could be another state.

⁴ From a Breit-Wigner fit to the Born cross section, including an s -dependent continuum amplitude.

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+K^-\eta = (21.7 \pm 1.9 +7.7 -8.3) \times 10^{-6}$.

⁶ From the fit to the BABAR data of LEES 13Q assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution. The resonance significance is 3.5σ .

⁷ From the fit to the BABAR data of LEES 13Q and BESIII data of ABLIKIM 19L assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution.

⁸ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (6.7 \pm 1.1 +2.2 -1.8) \times 10^{-6}$.

⁹ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

¹¹ Includes ATKINSON 85.

NODE=M032M3;LINKAGE=J

NODE=M032M3;LINKAGE=K

NODE=M032M3;LINKAGE=G

NODE=M032M3;LINKAGE=H

NODE=M032M3;LINKAGE=F

NODE=M032M3;LINKAGE=C

NODE=M032M3;LINKAGE=D

NODE=M032M3;LINKAGE=B

NODE=M032M3;LINKAGE=E

NODE=M032M3;LINKAGE=LE

NODE=M032M3;LINKAGE=A

 $\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
~ 2191	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2070	¹ OAKDEN	94 RVUE	$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 2170	² MARTIN	80B RVUE	
~ 2100	² MARTIN	80C RVUE	

¹ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

NODE=M032M1

NODE=M032M1

NODE=M032M1;LINKAGE=CC

NODE=M032M;LINKAGE=P

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2110 ± 35	¹ ANISOVICH	02 SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
~ 2190	² CUTTS	78B CNTR	0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{2,3} COUPLAND	77 CNTR	0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{2,4} ALSPECTOR	73 CNTR	$\bar{p}p$ S channel
2190 ± 10	⁵ ABRAMS	70 CNTR	S channel $\bar{p}N$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

² Isospins 0 and 1 not separated.

³ From a fit to the total elastic cross section.

⁴ Referred to as T or T region by ALSPECTOR 73.

⁵ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M032M2
NODE=M032M2

NODE=M032M;LINKAGE=AY

NODE=M032M;LINKAGE=I
NODE=M032M;LINKAGE=E
NODE=M032M;LINKAGE=M
NODE=M032M;LINKAGE=B

 $\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2140 ± 30	ALDE	95 GAM2	38 $\pi^-p \rightarrow \omega\pi^0n$
2170 ± 30	ALDE	92C GAM4	100 $\pi^-p \rightarrow \omega\pi^0n$

NODE=M032M4
NODE=M032M4

 $\rho(2150)$ WIDTH

NODE=M032210

 e^+e^- PRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
163 ± 69 ± 24		¹ ABLIKIM	23BQ BES3	$e^+e^- \rightarrow a_2(1320)^+\pi^- +$ c.c. $\rightarrow \eta\pi^+\pi^-$
270 ± 3		² ACHASOV	23A SND	$e^+e^- \rightarrow \omega\pi^0$
234 ± 30 ± 25		³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega\pi^0$
135 ± 34 ± 30		⁴ ABLIKIM	21X BES3	$e^+e^- \rightarrow \eta'\pi^+\pi^-$
460 + 54 + 160 - 48 - 90	1.8k	⁵ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+K^-\eta$
70 ± 38		⁶ LEES	20 BABR	$e^+e^- \rightarrow K^+K^-\eta$
127 ± 14 ± 4		⁷ LEES	20 RVUE	$e^+e^- \rightarrow K^+K^-$
196 ± 23 + 25 - 27		⁸ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+K^-\pi^0$
139.8 ± 12.3 ± 20.6		⁹ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+K^-$
109 ± 76		¹⁰ LEES	12G BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
350 ± 40 ± 50		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow$ $f_1(1285)\pi^+\pi^-\gamma$
310 ± 140		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$
389 ± 79		BIAGINI	91 RVUE	$e^+e^- \rightarrow \pi^+\pi^-, K^+K^-$
410 ± 100		¹¹ CLEGG	90 RVUE	$e^+e^- \rightarrow 3(\pi^+\pi^-),$ $2(\pi^+\pi^-\pi^0)$

OCCUR=2

OCCUR=2

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of a Breit-Wigner resonance and a non-resonant contribution. Could be another state.

² From a vector dominance fit to the Born cross section between 1.05 and 2.0 GeV with $\rho(770)$, $\rho(1570)$, $\rho(1700)$, $\rho(2150)$. The fit also uses SND data from the VEPP-2M collider below 1.02 GeV and from LEES 17H and ABLIKIM 21A above 1.5 GeV.

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\rho(770)$, $\rho(1450)$ and $\rho(1700)$. Could be another state.

⁴ From a Breit-Wigner fit to the Born cross section, including an s -dependent continuum amplitude.

⁵ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+K^-\eta = (21.7 \pm 1.9^{+7.7}_{-8.3}) \times 10^{-6}$.

⁶ From the fit to the BABAR data of LEES 13Q assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution. The resonance significance is 3.5σ .

⁷ From the fit to the BABAR data of LEES 13Q and BESIII data of ABLIKIM 19L assuming a coherent sum of a single Breit-Wigner resonance and a nonresonant contribution.

⁸ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (6.7 \pm 1.1^{+2.2}_{-1.8}) \times 10^{-6}$.

⁹ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹⁰ Using the GOUNARIS 68 parametrization of the pion form factor leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.

¹¹ Includes ATKINSON 85.

NODE=M032W3;LINKAGE=J

NODE=M032W3;LINKAGE=K

NODE=M032W3;LINKAGE=G

NODE=M032W3;LINKAGE=H

NODE=M032W3;LINKAGE=F

NODE=M032W3;LINKAGE=C

NODE=M032W3;LINKAGE=D

NODE=M032W3;LINKAGE=B

NODE=M032W3;LINKAGE=E

NODE=M032W3;LINKAGE=LE

NODE=M032W3;LINKAGE=A

$\bar{p}p \rightarrow \pi\pi$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 296	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 40	¹ OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 250	² MARTIN	80B	RVUE
~ 200	² MARTIN	80C	RVUE

¹ See however KLOET 96 who fit $\pi^+\pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^-\pi^+$ and $\pi^0\pi^0$.

NODE=M032W1
NODE=M032W1

NODE=M032W1;LINKAGE=CC

NODE=M032W;LINKAGE=P

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
230±50	¹ ANISOVICH	02	SPEC 0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
135±75	^{2,3} COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
98± 8	³ ALSPECTOR	73	CNTR $\bar{p}p$ S channel
~ 85	⁴ ABRAMS	70	CNTR S channel $\bar{p}N$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

² From a fit to the total elastic cross section.

³ Isospins 0 and 1 not separated.

⁴ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M032W2
NODE=M032W2

NODE=M032W;LINKAGE=AY

NODE=M032W;LINKAGE=E

NODE=M032W;LINKAGE=I

NODE=M032W;LINKAGE=B

 $\pi^-p \rightarrow \omega\pi^0n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
320±70	ALDE	95	GAM2 38 $\pi^-p \rightarrow \omega\pi^0n$
~ 300	ALDE	92C	GAM4 100 $\pi^-p \rightarrow \omega\pi^0n$

NODE=M032W4
NODE=M032W4

 $\rho(2150)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^-$	seen
Γ_3 K^+K^-	seen
Γ_4 $3(\pi^+\pi^-)$	seen
Γ_5 $2(\pi^+\pi^-\pi^0)$	seen
Γ_6 $\eta'\pi^+\pi^-$	seen
Γ_7 $f_1(1285)\pi^+\pi^-$	seen
Γ_8 $\omega\pi^0$	seen
Γ_9 $\omega\pi^0\eta$	seen
Γ_{10} $a_2(1320)\pi$	
Γ_{11} $p\bar{p}$	

NODE=M032215;NODE=M032

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=9;OUR EVAL;→ UNCHECKED ←

DESIG=12

DESIG=10

 $\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$ **$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_6\Gamma_1/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
23.3±5.3±3.3	¹ ABLIKIM	21X	BES3 $e^+e^- \rightarrow \eta'\pi^+\pi^-$

¹ From a Breit-Wigner fit to the Born cross section interfering constructively with the continuum. For destructive interference the value is $0.64 \pm 0.49 \pm 0.42$ eV.

NODE=M032220

NODE=M032R02
NODE=M032R02

NODE=M032R02;LINKAGE=A

 $\Gamma(\omega\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_8\Gamma_1/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
34±11±16	ABLIKIM	21A	BES3 $e^+e^- \rightarrow \omega\pi^0$

NODE=M032R00
NODE=M032R00

$$\Gamma(a_2(1320)\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{10}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

34.6 ± 17.1 ± 6.0	¹ ABLIKIM	23BQ BES3	$e^+e^- \rightarrow a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$

¹ From a solution of the fit to the cross section between 2.00 and 3.08 GeV using a coherent sum of a single Breit-Wigner resonance and a non-resonant contribution. $B(a_2(1320) \rightarrow \eta\pi) \times B(\eta \rightarrow \gamma\gamma)$ fixed to 0.057. Another solution with equal fit quality gives 137.1 ± 73.3 ± 2.1 eV.

NODE=M032R04
NODE=M032R04

NODE=M032R04;LINKAGE=A

$$\rho(2150) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$$

$$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10 ⁻⁷)	DOCUMENT ID	TECN	COMMENT

3.1 ± 0.6 ± 0.5	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow f_1(1285)\pi^+\pi^-\gamma$

¹ Calculated by us from the reported value of cross section at the peak.

NODE=M032230

NODE=M032G01
NODE=M032G01

NODE=M032G01;LINKAGE=AU

$$\Gamma(\eta'\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma \times \Gamma_1/\Gamma$$

VALUE (units 10 ⁻⁸)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ± 1.9	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta'\pi^+\pi^-\gamma$

¹ Calculated by us from the reported value of cross section at the peak.

NODE=M032G02
NODE=M032G02

NODE=M032G02;LINKAGE=AU

$\rho(2150)$ REFERENCES

ABLIKIM	23BQ	PR D108 L111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ACHASOV	23A	PR D108 092012	M.N. Achasov <i>et al.</i>	(SND Collab.)
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21X	PR D103 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	20	PR D101 012011	J.P. Lees <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19L	PR D99 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	17H	PR D96 092009	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	12G	PR D86 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
BIAGINI	91	NC 104A 363	M.E. Biagini <i>et al.</i>	(FRAS, PRAG)
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
PEASLEE	75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
COOPER	68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	

NODE=M032

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REFID=21805
REFID=48054

$\phi(2170)$

$$J^{PC} = 0^-(1^{--})$$

See the review on "Spectroscopy of Light Meson Resonances."

 $\phi(2170)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2164 ± 6 OUR AVERAGE				
[2163 ± 7 MeV OUR 2023 AVERAGE Scale factor = 1.1]				
2178 ± 20 ± 5		¹ ABLIKIM	23AX BES3	$e^+e^- \rightarrow \phi\pi^+\pi^-$
2190 ± 19 ± 37		² ABLIKIM	22L BES3	$2.0\text{--}3.08\ e^+e^- \rightarrow K^+K^-\pi^0$
2176 ± 24 ± 3		³ ABLIKIM	21A BES3	$e^+e^- \rightarrow \omega\eta$
2163.5 ± 6.2 ± 3.0		⁴ ABLIKIM	21T BES3	$e^+e^- \rightarrow \phi\eta$
2177.5 ± 4.8 ± 19.5		⁵ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta'\phi$
2126.5 ± 16.8 ± 12.4		⁶ ABLIKIM	20S BES3	$e^+e^- \rightarrow K^+K^-\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2215.7 ± 8.3		⁷ LICHARD	23 RVUE	$e^+e^- \rightarrow \Upsilon(nS) \rightarrow \phi\eta\gamma$
2169 ± 5 ± 6		⁸ ZHU	23A RVUE	$e^+e^- \rightarrow \eta\phi$
2273.7 ± 5.7 ± 19.3		⁹ ABLIKIM	21AP BES3	$e^+e^- \rightarrow K_S^0 K_L^0$
2135 ± 8 ± 9	95	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta\phi f_0(980)$
2239.2 ± 7.1 ± 11.3		¹⁰ ABLIKIM	19L BES3	$e^+e^- \rightarrow K^+K^-$
2200 ± 6 ± 5	471	ABLIKIM	15H BES3	$J/\psi \rightarrow \eta\phi\pi^+\pi^-$
2180 ± 8 ± 8	11,12	LEES	12F BABR	$10.6\ e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
2079 ± 13 $^{+79}_{-28}$	4.8k	¹³ SHEN	09 BELL	$10.6\ e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
2186 ± 10 ± 6	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta\phi f_0(980)$
2125 ± 22 ± 10	483	AUBERT	08S BABR	$10.6\ e^+e^- \rightarrow \phi\eta\gamma$
2192 ± 14	116	¹⁴ AUBERT	07AK BABR	$10.6\ e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
2169 ± 20	149	¹⁴ AUBERT	07AK BABR	$10.6\ e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$
2175 ± 10 ± 15	201	^{12,15} AUBERT,BE	06D BABR	$10.6\ e^+e^- \rightarrow K^+K^-\pi\pi\gamma$

¹ From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.

² By a simultaneous fit of the $K_2^*(1430)^+K^-$ and $K^*(892)^+K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.

⁴ From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.

⁵ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

⁶ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

⁷ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7σ statistical evidence.

⁸ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2σ .

⁹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

¹⁰ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹¹ Fit includes interference with the $\phi(1680)$.

¹² From the $\phi f_0(980)$ component.

¹³ From a fit with two incoherent Breit-Wigners.

¹⁴ From the $K^+K^-f_0(980)$ component.

¹⁵ Superseded by LEES 12F.

 $\phi(2170)$ WIDTH

NODE=M103

NODE=M103

NODE=M103M

NODE=M103M

NEW

OCCUR=2

NODE=M103M;LINKAGE=J

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NODE=M103M;LINKAGE=A

NODE=M103M;LINKAGE=AB

NODE=M103M;LINKAGE=SH

NODE=M103M;LINKAGE=AU

NODE=M103M;LINKAGE=B

NODE=M103W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

106 $\frac{+24}{-18}$ **OUR AVERAGE** Error includes scale factor of 2.0. See the ideogram below.

[103 $\frac{+28}{-21}$ MeV OUR 2023 AVERAGE Scale factor = 2.2]

140	± 36	± 16	1	ABLIKIM	23AX	BES3	$e^+e^- \rightarrow \phi\pi^+\pi^-$	
191	± 28	± 60	2	ABLIKIM	22L	BES3	$2.0\text{--}3.08 e^+e^- \rightarrow K^+K^-\pi^0$	
89	± 50	± 5	3	ABLIKIM	21A	BES3	$e^+e^- \rightarrow \omega\eta$	
$31.1^{+21.1}_{-11.6} \pm 1.1$			4	ABLIKIM	21T	BES3	$e^+e^- \rightarrow \phi\eta$	
$149.0 \pm 15.6 \pm 8.9$			5	ABLIKIM	20M	BES3	$e^+e^- \rightarrow \eta'\phi$	
$106.9 \pm 32.1 \pm 28.1$			6	ABLIKIM	20S	BES3	$e^+e^- \rightarrow K^+K^-\pi^0\pi^0$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●								
35	± 23		7	LICHARD	23	RVUE	$e^+e^- \rightarrow \mathcal{R}(nS) \rightarrow \phi\eta\gamma$	
96	$\frac{+17}{-14} \pm 9$		8	ZHU	23A	RVUE	$e^+e^- \rightarrow \eta\phi$	
86	± 44	± 51	9	ABLIKIM	21AP	BES3	$e^+e^- \rightarrow K_S^0 K_L^0$	
104	± 24	± 12	95	ABLIKIM	19I	BES3	$e^+e^- \rightarrow \eta\phi f_0(980)$	
$139.8 \pm 12.3 \pm 20.6$			10	ABLIKIM	19L	BES3	$e^+e^- \rightarrow K^+K^-$	
104	± 15	± 15	471	ABLIKIM	15H	BES3	$J/\psi \rightarrow \eta\phi\pi^+\pi^-$	
77	± 15	± 10	11,12	LEES	12F	BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$	
192	± 23	$\frac{+25}{-61}$	4.8k	13	SHEN	09	BELL	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
65	± 23	± 17	52	ABLIKIM	08F	BES	$J/\psi \rightarrow \eta\phi f_0(980)$	
61	± 50	± 13	483	AUBERT	08S	BABR	$10.6 e^+e^- \rightarrow \phi\eta\gamma$	
71	± 21		116	14	AUBERT	07AK	BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
102	± 27		149	14	AUBERT	07AK	BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$
58	± 16	± 20	201	12,15	AUBERT,BE	06D	BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi\pi\gamma$

¹ From a fit to the e^+e^- cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.

² By a simultaneous fit of the $K_2^*(1430)^+K^-$ and $K^*(892)^+K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

³ From a fit to the cross section between 2.00 and 3.08 GeV with a coherent sum of Breit-Wigner amplitudes, including contributions from $\omega(1420)$ and $\omega(1650)/\phi(1680)$.

⁴ From a fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term.

⁵ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

⁶ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

⁷ From a VDM fit to ZHU 23 $\eta\phi\gamma$ data with two resonances, $\phi(1680)$, $\phi(2170)$, and a third resonance with mass 1850.7 ± 5.3 MeV and width 25 ± 35 MeV of 1.7σ statistical evidence.

⁸ From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2σ .

⁹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

¹⁰ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

¹¹ Fit includes interference with the $\phi(1680)$.

¹² From the $\phi f_0(980)$ component.

¹³ From a fit with two incoherent Breit-Wigners.

¹⁴ From the $K^+K^-f_0(980)$ component.

¹⁵ Superseded by LEES 12F.

NODE=M103W

NEW

OCCUR=2

NODE=M103W;LINKAGE=J

NODE=M103W;LINKAGE=I

NODE=M103W;LINKAGE=F

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NODE=M103W;LINKAGE=L

NODE=M103W;LINKAGE=H

NODE=M103W;LINKAGE=C

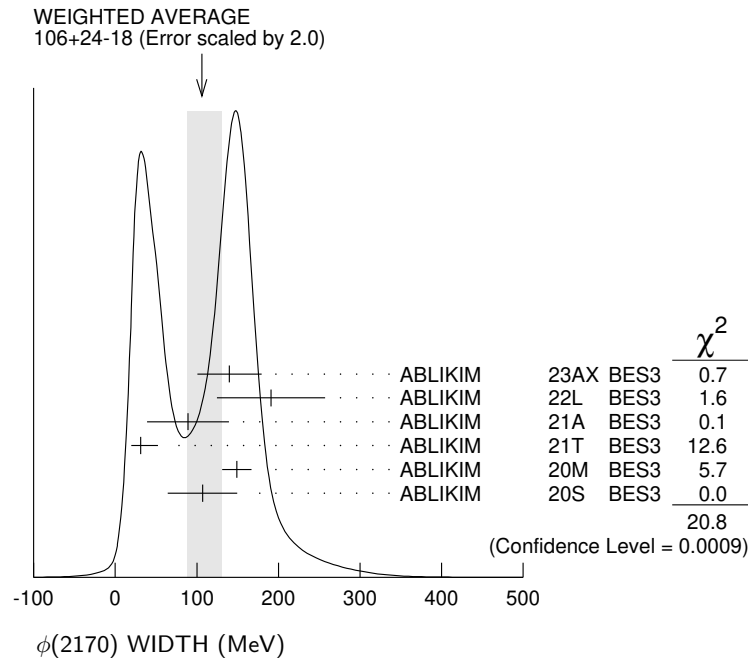
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NODE=M103W;LINKAGE=SH

NODE=M103W;LINKAGE=AU

NODE=M103W;LINKAGE=B



$\phi(2170)$ DECAY MODES

NODE=M103215;NODE=M103

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\phi\eta$	seen
Γ_3 $\omega\eta$	seen
Γ_4 $\phi\eta'$	seen
Γ_5 $\phi\pi\pi$	seen
Γ_6 $\phi f_0(980)$	seen
Γ_7 $K_S^0 K_L^0$	
Γ_8 $K^+ K^- \pi^+ \pi^-$	
Γ_9 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
Γ_{10} $K^+ K^- \pi^0 \pi^0$	
Γ_{11} $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
Γ_{12} $K^{*0} K^\pm \pi^\mp$	not seen
Γ_{13} $K^*(892)^0 \bar{K}^*(892)^0$	not seen
Γ_{14} $K^*(892)^+ K^*(892)^-$	
Γ_{15} $K^*(892)^+ K^- + \text{c.c.}$	
Γ_{16} $K(1460)^+ K^- + \text{c.c.}$	
Γ_{17} $K_1(1270)^+ K^- + \text{c.c.}$	
Γ_{18} $K_1(1400)^+ K^- + \text{c.c.}$	
Γ_{19} $K_2^*(1430)^+ K^- + \text{c.c.}$	

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=5;OUR EVAL;→ UNCHECKED ←
 DESIG=16;OUR EVAL;→ UNCHECKED ←
 DESIG=11;OUR EVAL;→ UNCHECKED ←
 DESIG=9
 DESIG=2;OUR EVAL;→ UNCHECKED ←
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 DESIG=6
 DESIG=4
 DESIG=7
 DESIG=8
 DESIG=10
 DESIG=15
 DESIG=19
 DESIG=12
 DESIG=14
 DESIG=13
 DESIG=18

$\phi(2170) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

NODE=M103230

$\Gamma(\phi\eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL% EVTS DOCUMENT ID TECN COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●	
0.17	90 1 ZHU 23 BELL $e^+ e^- \rightarrow \gamma(nS) \rightarrow \phi\eta\gamma$
$0.36^{+0.05}_{-0.03} \pm 0.07$ to $41 \pm 2 \pm 6$	2 ZHU 23A RVUE $e^+ e^- \rightarrow \eta\phi$
$0.24^{+0.12}_{-0.07}$	3 ABLIKIM 21T BES3 $e^+ e^- \rightarrow \phi\eta$
$1.7 \pm 0.7 \pm 1.3$	483 AUBERT 08S BABR $10.6 e^+ e^- \rightarrow \phi\eta\gamma$

NODE=M103G2
 NODE=M103G2

¹ From a solution of the fit using a vector meson dominance model with contributions from $\phi(1680)$, $\phi(2170)$ and non resonant contribution with mass and width of $\phi(2170)$ fixed at 2163.5 MeV and 31.1 MeV respectively. Four solutions are found with equal fit quality giving 0.17 eV (solution I and II) and 18.6 eV (III and IV) at 90% CL.

² From the analysis of the combined measurements of $\sigma(e^+e^- \rightarrow \eta\phi)$ from BaBar, Belle, BESIII, CMD3. The statistical significance for $\phi(2170)$ is 7.2σ . Four solutions are found, with equal fit quality: $(0.56^{+0.03}_{-0.02} \pm 0.07)$ eV, $(0.36^{+0.05}_{-0.03} \pm 0.07)$ eV, $(38 \pm 1 \pm 5)$ eV, $(41 \pm 2 \pm 6)$ eV.

³ From a solution of the fit to the cross section below 3.5 GeV measured by BaBar and BESIII with a coherent sum of two modified Breit-Wigner amplitudes ($\phi(1680)$ and $\phi(2170)$) and a nonresonant term. The other solution gives $10.11^{+3.87}_{-3.13}$ eV.

NODE=M103G2;LINKAGE=B

NODE=M103G2;LINKAGE=C

NODE=M103G2;LINKAGE=A

$\Gamma(\omega\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
$0.43 \pm 0.15 \pm 0.04$	¹ ABLIKIM	21A	BES3	$e^+e^- \rightarrow \omega\eta$	

NODE=M103R09
NODE=M103R09

¹ For constructive interference with $\omega(1420)$ and $\omega(1650)/\phi(1680)$. For destructive interference: $1.25 \pm 0.48 \pm 0.18$ eV.

NODE=M103R09;LINKAGE=A

$\Gamma(\phi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_4\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
$7.1 \pm 0.7 \pm 0.7$	¹ ABLIKIM	20M	BES3	$e^+e^- \rightarrow \eta'\phi$	

NODE=M103R00
NODE=M103R00

¹ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

NODE=M103R00;LINKAGE=A

$\Gamma(\phi f_0(980)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_6\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					

NODE=M103G1
NODE=M103G1

$2.3 \pm 0.3 \pm 0.3$	^{1,2} LEES	12F	BABR	$10.6 e^+e^- \rightarrow \phi\pi^+\pi^-\gamma$
$2.5 \pm 0.8 \pm 0.4$	201 ^{2,3} AUBERT, BE	06D	BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi\pi\gamma$

¹ From a fit with constructive interference with the $\phi(1680)$. In a fit with destructive interference, the value is larger by a factor of 12.

NODE=M103G1;LINKAGE=A

² For $f_0(980) \rightarrow \pi\pi$.

NODE=M103G1;LINKAGE=AB
NODE=M103G1;LINKAGE=B

³ Superseded by LEES 12F.

$\Gamma(K_S^0 K_L^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_7\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.9 \pm 0.6 \pm 0.7$	¹ ABLIKIM	21AP	BES3	$e^+e^- \rightarrow K_S^0 K_L^0$	

NODE=M103R10
NODE=M103R10

¹ From a fit to the cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a nonresonant contribution. The observed structure can be also due to $\rho(2150)$.

NODE=M103R10;LINKAGE=A

$\Gamma(K^*(892)^+ K^*(892)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{14}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.9	90	¹ ABLIKIM	20S	BES3	$e^+e^- \rightarrow K^+K^-\pi^0\pi^0$

NODE=M103R08
NODE=M103R08

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

NODE=M103R08;LINKAGE=A

$\Gamma(K^*(892)^+ K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{15}\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					

NODE=M103R11
NODE=M103R11

1.0 ± 0.3	¹ ABLIKIM	22L	BES3	$2.0-3.08 e^+e^- \rightarrow K^+K^-\pi^0$

¹ From a solution of a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 7.1 ± 0.9 eV. Significance 3.7σ .

NODE=M103R11;LINKAGE=A

$\Gamma(K(1460)^+ K^- + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{16}\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.0 ± 3.8	¹ ABLIKIM	20S	BES3	$e^+e^- \rightarrow K^+K^-\pi^0\pi^0$	

NODE=M103R05
NODE=M103R05

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function.

NODE=M103R05;LINKAGE=A

$$\Gamma(K_1(1270)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{17} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<12.5	90	¹ ABLIKIM	20s BES3	$e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives an upper limit value of 297.6 eV.

NODE=M103R06
NODE=M103R06

NODE=M103R06;LINKAGE=A

$$\Gamma(K_1(1400)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{18} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.7 ± 3.3	¹ ABLIKIM	20s BES3	$e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$

¹ By a simultaneous fit of the intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. A second solution of the fit with equal fit quality gives a value of 98.8 ± 7.8 eV.

NODE=M103R07
NODE=M103R07

NODE=M103R07;LINKAGE=A

$$\Gamma(K_2^*(1430)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{19} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

12.6 ± 2.4	¹ ABLIKIM	22L BES3	2.0–3.08 $e^+ e^- \rightarrow K^+ K^- \pi^0$

¹ From a solution of a simultaneous fit of the $K_2^*(1430)^+ K^-$ and $K^*(892)^+ K^-$ intermediate channels in a partial-wave analysis, assuming the same structure, modelled with a coherent sum of a nonresonant component and a resonant component by a Breit-Wigner function. The other solution gives 161.1 ± 20.6 eV.

NODE=M103R12
NODE=M103R12

NODE=M103R12;LINKAGE=A

$$\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$$

NODE=M103220

$$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma \times \Gamma_1 / \Gamma$$

VALUE (units 10 ⁻⁷)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.65 ± 0.15 ± 0.18	4.8k	¹ SHEN	09 BELL	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ Multiplied by 3/2 to take into account the $\phi \pi^0 \pi^0$ mode. Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.6)\%$.

NODE=M103G01
NODE=M103G01

NODE=M103G01;LINKAGE=SH

$\phi(2170)$ BRANCHING RATIOS

NODE=M103225

$$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ ABLIKIM	23AX BES3	$e^+ e^- \rightarrow \phi \pi^+ \pi^-$

¹ From a fit to the $e^+ e^-$ cross section between 2.00 and 3.08 GeV with a sum of Breit-Wigner amplitude and a non-resonant contribution.

NODE=M103R13
NODE=M103R13

NODE=M103R13;LINKAGE=A

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

NODE=M103R01
NODE=M103R01

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{11} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$

NODE=M103R02
NODE=M103R02

$$\Gamma(K^{*0} K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{12} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	AUBERT	07AK BABR	10.6 GeV $e^+ e^-$

NODE=M103R03
NODE=M103R03

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) / \Gamma_{\text{total}} \quad \Gamma_{13} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	ABLIKIM	10C BES2	$J/\psi \rightarrow \eta K^+ \pi^- K^- \pi^+$

NODE=M103R04
NODE=M103R04

$\phi(2170)$ REFERENCES

ABLIKIM	23AX	PR D108 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LICHARD	23	PR D108 092005	P. Lichard	(OPAV, CTUP)
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)
ZHU	23A	CP C47 113003	W. Zhu, X. Wang	(RVUE)
ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21A	PL B813 136059	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AP	PR D104 092014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21T	PR D104 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20M	PR D102 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20S	PRL 124 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19I	PR D99 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19L	PR D99 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M103

REFID=62350
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REFID=52242
REFID=51908
REFID=51511

NODE=M112

 $f_0(2200)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

Seen in $K_S^0 K_S^0$ (AUGUSTIN 88), $K^+ K^-$ (ABLIKIM 05Q) and $\eta\eta$ (BINON 05) system. Not seen in $\mathcal{T}(1S)$ radiative decays (BARU 89).

NODE=M112

 $f_0(2200)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2187±14 OUR AVERAGE				
$2170 \pm 20^{+10}_{-15}$		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
2197 ± 17		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2200 ± 25		SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
$2206 \pm 12 \pm 8$	381	^{2,3} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
$2188 \pm 17 \pm 16$	203	^{2,3} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
2210 ± 50		⁴ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta\eta n$
~ 2122		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2321		HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M112M

NODE=M112M

OCCUR=2

OCCUR=2

¹ Cannot determine spin to be 0.² Using CLEO-c data but not authored by the CLEO Collaboration.³ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 238$ MeV.⁴ First solution, PWA is ambiguous.

NODE=M112M;LINKAGE=A
NODE=M112M;LINKAGE=B
NODE=M112M;LINKAGE=C
NODE=M112M;LINKAGE=BI

 $f_0(2200)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
210±40 OUR AVERAGE			
[207 ± 40 MeV OUR 2023 AVERAGE]			
$220 \pm 60^{+40}_{-45}$	ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
201 ± 51	⁵ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
150 ± 30	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
380 ± 90	⁶ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta\eta n$
~ 273	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 223	HASAN	94 RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M112W

NODE=M112W

NEW

OCCUR=2

⁵ Cannot determine spin to be 0.⁶ First solution, PWA is ambiguous.

NODE=M112W;LINKAGE=A
NODE=M112W;LINKAGE=BI

 $f_0(2200)$ REFERENCES

SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)

NODE=M112

REFID=61091
REFID=56805
REFID=50958
REFID=50780
REFID=44103
REFID=40917
REFID=40574

$f_J(2220)$

$$I^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$$

OMITTED FROM SUMMARY TABLE

See our mini-review in the 2004 edition of this *Review*, PDG 04. **$f_J(2220)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2231.1 ± 3.5 OUR AVERAGE				
2235 ± 4 ± 6	74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
2230 $^{+6}_{-7}$ ± 16	46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
2232 $^{+8}_{-7}$ ± 15	23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
2235 ± 4 ± 5	32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
2209 $^{+17}_{-15}$ ± 10		ASTON	88F LASS	11 $K^- p \rightarrow K^+ K^- \Lambda$
2230 ± 20		BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2220 ± 10	41	¹ ALDE	86B GA24	38-100 $\pi p \rightarrow n\eta\eta'$
2230 ± 6 ± 14	93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+ K^-$
2232 ± 7 ± 7	23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2223.9 ± 2.5		² VLADIMIRSK...08	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$
2246 ± 36		BAI	98H BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$
¹ ALDE 86B uses data from both the GAMS-2000 and GAMS-4000 detectors. ² $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated				

 $f_J(2220)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
23 $^{+8}_{-7}$ OUR AVERAGE					
19 $^{+13}_{-11}$ ± 12		74	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
20 $^{+20}_{-15}$ ± 17		46	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
20 $^{+25}_{-16}$ ± 14		23	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
15 $^{+12}_{-9}$ ± 9		32	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}$
60 $^{+107}_{-57}$			ASTON	88F LASS	11 $K^- p \rightarrow K^+ K^- \Lambda$
80 ± 30			BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
26 $^{+20}_{-16}$ ± 17		93	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K^+ K^-$
18 $^{+23}_{-15}$ ± 10		23	BALTRUSAIT..86D	MRK3	$e^+e^- \rightarrow \gamma K_S^0 K_S^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.6 ± 2.5			¹ VLADIMIRSK...08	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$
<80	90		ALDE	87C GAM2	38 $\pi^- p \rightarrow \eta'\eta n$
¹ $J^{PC} = 2^{++}$. Systematic uncertainties not evaluated					

 $f_J(2220)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi\pi$	not seen
$\Gamma_2 \pi^+\pi^-$	not seen
$\Gamma_3 K\bar{K}$	not seen
$\Gamma_4 p\bar{p}$	not seen
$\Gamma_5 \gamma\gamma$	not seen
$\Gamma_6 \eta\eta'(958)$	seen
$\Gamma_7 \phi\phi$	not seen
$\Gamma_8 \eta\eta$	not seen

NODE=M082

NODE=M082

NODE=M082M

NODE=M082M

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

NODE=M082M;LINKAGE=A
NODE=M082M;LINKAGE=VL

NODE=M082W

NODE=M082W

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

NODE=M082W;LINKAGE=VL

NODE=M082215;NODE=M082

DESIG=5

DESIG=6;OUR EST;→ UNCHECKED ←
DESIG=1DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=8;OUR EST;→ UNCHECKED ←

$f_J(2220) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M082220

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.4	95	¹ ACCIARRI	01H L3	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183\text{--}209 \text{ GeV}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5.6	95	¹ GODANG	97 CLE2	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 86	95	¹ ALBRECHT	90G ARG	$\gamma\gamma \rightarrow K^+ K^-$
< 1000	95	² ALTHOFF	85B TASS	$\gamma\gamma, K\bar{K}\pi$

 $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_5 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	95	ALAM	98C CLE2	$\gamma\gamma \rightarrow \pi^+ \pi^-$

¹ Assuming $J^P = 2^+$.² True for $J^P = 0^+$ and $J^P = 2^+$.NODE=M082G3
NODE=M082G3NODE=M082G1;LINKAGE=D
NODE=M082G1;LINKAGE=C $f_J(2220) \Gamma(i) \Gamma(p\bar{p}) / \Gamma^2(\text{total})$

NODE=M082223

 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\pi\pi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 18	95	¹ AMSLER	01 CBAR	$1.4\text{--}1.5 p\bar{p} \rightarrow \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< (11–42)	99	² HASAN	96 SPEC	$1.35\text{--}1.55 p\bar{p} \rightarrow \pi^+ \pi^-$

NODE=M082GG1
NODE=M082GG1 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\phi\phi) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_7 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	95	³ EVANGELIS...	98 SPEC	$1.1\text{--}2.0 p\bar{p} \rightarrow \phi\phi$

NODE=M082GG2
NODE=M082GG2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\eta\eta) / \Gamma_{\text{total}}$ $\Gamma_4 / \Gamma \times \Gamma_8 / \Gamma$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	95	¹ AMSLER	01 CBAR	$1.4\text{--}1.5 p\bar{p} \rightarrow \eta\eta$

¹ For $J^P = 2^+$ in the mass range 2222–2240 MeV and the total width between 10 and 20 MeV.² For $J^P = 2^+$ and $J^P = 4^+$ in the mass range 2220–2245 MeV and the total width of 15 MeV.³ For $J^P = 2^+$, the mass of 2235 MeV and the total width of 15 MeV.NODE=M082GG3
NODE=M082GG3

NODE=M082GG;LINKAGE=A

NODE=M082GG;LINKAGE=B

NODE=M082GG;LINKAGE=C

 $f_J(2220) \text{ BRANCHING RATIOS}$

NODE=M082225

 $\Gamma(\pi\pi) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	DOCUMENT ID	COMMENT
not seen	¹ DOBBS 15	$J/\psi \rightarrow \gamma\pi\pi$
not seen	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma\pi\pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M082R00
NODE=M082R00

OCCUR=2

NODE=M082R00;LINKAGE=A

 $\Gamma(K\bar{K}) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE	DOCUMENT ID	COMMENT
not seen	¹ DOBBS 15	$J/\psi \rightarrow \gamma K\bar{K}$
not seen	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K\bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.NODE=M082R01
NODE=M082R01

OCCUR=2

NODE=M082R01;LINKAGE=A

 $\Gamma(\pi\pi) / \Gamma(K\bar{K})$ Γ_1 / Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.0 ± 0.5	BAI 96B	BES	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma 2\pi, K\bar{K}$

NODE=M082R2
NODE=M082R2 $\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen		¹ AUBERT	07AV BABR	$B \rightarrow p\bar{p}K(*)$
not seen		WANG	05A BELL	$B^+ \rightarrow \bar{p}pK^+$
< 3.0	95	² EVANGELIS...	97 SPEC	$1.96\text{--}2.40 p\bar{p} \rightarrow K_S^0 K_S^0$
< 1.1	99.7	³ BARNES	93 SPEC	$1.3\text{--}1.57 p\bar{p} \rightarrow K_S^0 K_S^0$
< 2.6	99.7	³ BARDIN	87 CNTR	$1.3\text{--}1.5 p\bar{p} \rightarrow K^+ K^-$
< 3.6	99.7	³ SCULLI	87 CNTR	$1.29\text{--}1.55 p\bar{p} \rightarrow K^+ K^-$

NODE=M082R1
NODE=M082R1

¹ Assuming $\Gamma < 30$ MeV.² Assuming $\Gamma \sim 20$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.³ Assuming $\Gamma = 30\text{--}35$ MeV, $J^P = 2^+$ and $B(f_J(2220) \rightarrow K\bar{K}) = 100\%$.

NODE=M082R1;LINKAGE=AU

NODE=M082R1;LINKAGE=C

NODE=M082R1;LINKAGE=B

 $\Gamma(p\bar{p})/\Gamma(K\bar{K})$ Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.17±0.09	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p\bar{p}, K\bar{K}$

NODE=M082R3

NODE=M082R3

 $f_J(2220)$ REFERENCES

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirsky <i>et al.</i>	(ITEP)
		Translated from YAF 71 2166.		
AUBERT	07AV	PR D76 092004	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	05A	PL B617 141	M.-Z. Wang <i>et al.</i>	(BELLE Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ACCIARRI	01H	PL B501 173	M. Acciarri <i>et al.</i>	(L3 Collab.)
AMSLER	01	PL B520 175	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ALAM	98C	PRL 81 3328	M.S. Alam <i>et al.</i>	(CLEO Collab.)
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)
EVANGELIS...	98	PR D57 5370	C. Evangelista <i>et al.</i>	(JETSET Collab.)
EVANGELIS...	97	PR D56 3803	C. Evangelista <i>et al.</i>	(LEAR Collab.)
GODANG	97	PRL 79 3829	R. Godang <i>et al.</i>	(CLEO Collab.)
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ASTON	88F	PL B215 199	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP
BOLONKIN	88	NP B309 426	B.V. Bolonkin <i>et al.</i>	(ITEP, SERP)
ALDE	87C	SJNP 45 255	D. Alde <i>et al.</i>	
		Translated from YAF 45 405.		
BARDIN	87	PL B195 292	G. Bardin <i>et al.</i>	(SACL, FERR, CERN, PADO+)
SCULLI	87	PRL 58 1715	J. Sculli <i>et al.</i>	(NYU, BNL)
ALDE	86B	PL B177 120	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)

NODE=M082

REFID=56805

REFID=52681

REFID=51990

REFID=50651

REFID=49653

REFID=48321

REFID=48558

REFID=46326

REFID=46342

REFID=46365

REFID=45687

REFID=45760

REFID=44736

REFID=45197

REFID=43601

REFID=41374

REFID=40585

REFID=40580

REFID=47474

REFID=40235

REFID=40023

REFID=21864

REFID=21865

REFID=21349

OTHER RELATED PAPERS

DEL-AMO-SA... 100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

REFID=53533

NODE=M270

 $\omega(2220)$

$$I^G(J^{PC}) = 0^-(1^--)$$

OMITTED FROM SUMMARY TABLE

 $\omega(2220)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2232±19±27	¹ ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2250±25±27	² ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi^+\pi^-$
2222± 7± 2	³ ABLIKIM	22I BES3	2.0–3.8 $e^+e^- \rightarrow \omega\pi^0\pi^0$
2205±30	⁴ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

¹ From a fit to $\omega\pi^+\pi^-$ and $\omega\pi^0\pi^0$ with a Breit-Wigner resonance interfering with the continuum. Supersedes ABLIKIM 22I.² From a fit to $\omega\pi^+\pi^-$ with a Breit-Wigner resonance interfering with the continuum.³ From the fit to the cross section by the coherent sum of resonant component parametrized by a modified Breit-Wigner amplitude and a phase-space contribution for the continuum.⁴ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M270M

NODE=M270M

OCCUR=2

NODE=M270M;LINKAGE=A

NODE=M270M;LINKAGE=B

NODE=M270M;LINKAGE=C

NODE=M270M;LINKAGE=D

 $\omega(2220)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
93±53±20	⁵ ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
125±43±15	⁶ ABLIKIM	23G BES3	2.0–3.1 $e^+e^- \rightarrow \omega\pi^+\pi^-$
59±30± 6	⁷ ABLIKIM	22I BES3	2.0–3.8 $e^+e^- \rightarrow \omega\pi^0\pi^0$
350±90	⁸ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

⁵ From a fit to $\omega\pi^+\pi^-$ and $\omega\pi^0\pi^0$ with a Breit-Wigner resonance interfering with the continuum. Supersedes ABLIKIM 22I.⁶ From a fit to $\omega\pi^+\pi^-$ with a Breit-Wigner resonance interfering with the continuum.⁷ From the fit to the cross section by the coherent sum of resonant component parametrized by a modified Breit-Wigner amplitude and a phase-space contribution for the continuum.⁸ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M270W

NODE=M270W

OCCUR=2

NODE=M270W;LINKAGE=A

NODE=M270W;LINKAGE=B

NODE=M270W;LINKAGE=C

NODE=M270W;LINKAGE=D

$\omega(2220)$ DECAY MODES

NODE=M270215;NODE=M270

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega\pi\pi$	seen
Γ_2 $\omega\pi^+\pi^-$	seen
Γ_3 $\omega\pi^0\pi^0$	seen
Γ_4 e^+e^-	seen

DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←

 $\omega(2220) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M270235

$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M270G00
 NODE=M270G00

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.3 \pm 0.1 \pm 0.1$ ⁹ ABLIKIM 22I BES3 2.0–3.8 $e^+e^- \rightarrow \omega\pi^0\pi^0$

⁹ Superseded by ABLIKIM 23G.

NODE=M270G00;LINKAGE=A

$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M270R01
 NODE=M270R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.9 \pm 0.4 \pm 0.4$ ¹⁰ ABLIKIM 23G BES3 2.0–3.1 $e^+e^- \rightarrow \omega\pi^+\pi^-$

¹⁰ From a fit to $\omega\pi^+\pi^-$ with a Breit-Wigner resonance interfering with the continuum. Solution with constructive interference: $52.9 \pm 17.0 \pm 13.1$ eV.

NODE=M270R01;LINKAGE=A

$\Gamma(\omega\pi\pi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M270R00
 NODE=M270R00

$0.9 \pm 0.5 \pm 0.2$ ¹¹ ABLIKIM 23G BES3 2.0–3.1 $e^+e^- \rightarrow \omega\pi\pi$

¹¹ From a fit to $\omega\pi^+\pi^-$ and $\omega\pi^0\pi^0$ with a Breit-Wigner resonance interfering with the continuum. Solution with constructive interference: $61.1 \pm 32.1 \pm 15.4$ eV. Supersedes ABLIKIM 22I.

NODE=M270R00;LINKAGE=A

 $\omega(2220)$ REFERENCES

NODE=M270

ABLIKIM 23G JHEP 2301 111 M. Ablikim <i>et al.</i> (BESIII Collab.)	REFID=62049
Also JHEP 2303 093 (errat.) M. Ablikim, <i>et. al.</i> (BESIII Collab.)	REFID=62054
ABLIKIM 22I PR D105 032005 M. Ablikim <i>et al.</i> (BESIII Collab.)	REFID=61644
ANISOVICH 02B PL B542 19 A.V. Anisovich <i>et al.</i>	REFID=48829
ANISOVICH 01C PL B507 23 A.V. Anisovich <i>et al.</i>	REFID=48325
ANISOVICH 00D PL B476 15 A.V. Anisovich <i>et al.</i>	REFID=47944

NODE=M115

 $\eta(2225)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Seen in $J/\psi \rightarrow \gamma\phi\phi$. Possibly seen in $B \rightarrow \phi\phi K$ by LEES 11A.

NODE=M115

 $\eta(2225)$ MASS

NODE=M115M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M115M

2221^{+13}_{-10} OUR AVERAGE

2216^{+4+21}_{-5-11} ¹ ABLIKIM 16N BES3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

2240^{+30+30}_{-20-20} 196 ± 19 ABLIKIM 08I BES $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

$2230 \pm 25 \pm 15$ BAI 90B MRK3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

$2214 \pm 20 \pm 13$ BAI 90B MRK3 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2220 BISELLO 86B DM2 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma \phi \phi$ that also finds significant signals for $\eta(2100)$, 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M115M;LINKAGE=B

 $\eta(2225)$ WIDTH

NODE=M115W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M115W

 185^{+40}_{-20} OUR AVERAGE

185^{+12+43}_{-14-17}		¹ ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$190 \pm 30^{+60}_{-40}$	196 ± 19	ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$150^{+300}_{-60} \pm 60$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 80		BISELLO	86B DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma \phi \phi$ that also finds significant signals for $\eta(2100)$, 0^{-+} phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^{-+} state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M115W;LINKAGE=A

 $\eta(2225)$ REFERENCES

NODE=M115

ABLIKIM	16N	PR D93 112011	M. Ablikim	(BESIII Collab.)
LEES	11A	PR D84 012001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)

REFID=57512
REFID=16595
REFID=52255
REFID=41354
REFID=22101

 $\rho_3(2250)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

NODE=M044

OMITTED FROM SUMMARY TABLE

Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $f_4(2300)$, $\rho_5(2350)$.

NODE=M044

 $\rho_3(2250)$ MASS

NODE=M044205

 $\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M044M1
NODE=M044M1

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2248 \pm 17^{+59}_{-5}$	1.8k	¹ ABLIKIM	20F BES3		$\psi(2S) \rightarrow K^+ K^- \eta$
~ 2232		HASAN	94 RVUE		$\bar{p}p \rightarrow \pi\pi$
~ 2090		² OAKDEN	94 RVUE		$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 2250		³ MARTIN	80B RVUE		
~ 2300		³ MARTIN	80C RVUE		
~ 2140		⁴ CARTER	78B CNTR 0		$0.7\text{--}2.4 \bar{p}p \rightarrow K^- K^+$
~ 2150		⁵ CARTER	77 CNTR 0		$0.7\text{--}2.4 \bar{p}p \rightarrow \pi\pi$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

NODE=M044M1;LINKAGE=A

² See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

NODE=M044M1;LINKAGE=CC

³ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

NODE=M044M1;LINKAGE=P

⁴ $I = 0, 1$. $J^P = 3^-$ from Barrelet-zero analysis.

NODE=M044M1;LINKAGE=K

⁵ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044M1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M044M2
NODE=M044M2

• • • We do not use the following data for averages, fits, limits, etc. • • •

2260 ± 20	⁶ ANISOVICH	02 SPEC		$0.6\text{--}1.9 \bar{p}p \rightarrow \omega \pi^0$, $\omega \eta \pi^0, \pi^+ \pi^-$
~ 2190	⁷ CUTTS	78B CNTR		$0.97\text{--}3 \bar{p}p \rightarrow \bar{N}N$
2155 ± 15	^{7,8} COUPLAND	77 CNTR 0		$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
2193 ± 2	^{7,9} ALSPECTOR	73 CNTR		$\bar{p}p$ S channel
2190 ± 10	¹⁰ ABRAMS	70 CNTR		S channel $\bar{p}N$

- ⁶ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.
⁷ Isospins 0 and 1 not separated.
⁸ From a fit to the total elastic cross section.
⁹ Referred to as T or T region by ALSPECTOR 73.
¹⁰ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

Other processes

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2290 \pm 20 \pm 30$	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M044M;LINKAGE=AY

NODE=M044M2;LINKAGE=I
 NODE=M044M2;LINKAGE=E
 NODE=M044M2;LINKAGE=M
 NODE=M044M2;LINKAGE=B

NODE=M044M3
 NODE=M044M3

$\rho_3(2250)$ WIDTH

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$185^{+31+17}_{-26-103}$	1.8k	¹¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
~ 220		HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 60		¹² OAKDEN	94	RVUE	$0.36-1.55 \bar{p}p \rightarrow \pi\pi$
~ 250		¹³ MARTIN	80B	RVUE	
~ 200		¹³ MARTIN	80C	RVUE	
~ 150		¹⁴ CARTER	78B	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow K^- K^+$
~ 200		¹⁵ CARTER	77	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow \pi\pi$

NODE=M044210

NODE=M044W1
 NODE=M044W1

¹¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

NODE=M044W1;LINKAGE=A

¹² See however KLOET 96 who fit $\pi^+ \pi^-$ only and find waves only up to $J = 3$ to be important but not significantly resonant.

NODE=M044W1;LINKAGE=CC

¹³ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

NODE=M044W1;LINKAGE=P

¹⁴ $I = 0, 1$. $J^P = 3^-$ from Barrelet-zero analysis.

NODE=M044W1;LINKAGE=K

¹⁵ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044W1;LINKAGE=J

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
160 ± 25	¹⁶ ANISOVICH	02	SPEC	$0.6-1.9 \bar{p}p \rightarrow \omega \pi^0$, $\omega \eta \pi^0, \pi^+ \pi^-$
135 ± 75	^{17,18} COUPLAND	77	CNTR 0	$0.7-2.4 \bar{p}p \rightarrow \bar{p}p$
98 ± 8	¹⁸ ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	¹⁹ ABRAMS	70	CNTR	S channel $\bar{p}N$

NODE=M044W2
 NODE=M044W2

¹⁶ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M044W;LINKAGE=AY

¹⁷ From a fit to the total elastic cross section.

NODE=M044W2;LINKAGE=E

¹⁸ Isospins 0 and 1 not separated.

NODE=M044W2;LINKAGE=I

¹⁹ Seen as bump in $I = 1$ state. See also COOPER 68. PEASLEE 75 confirm $\bar{p}p$ results of ABRAMS 70, no narrow structure.

NODE=M044W2;LINKAGE=B

Other processes

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$230 \pm 50 \pm 80$	AMELIN	00 VES	$37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M044W3
 NODE=M044W3

$\rho_3(2250)$ REFERENCES

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
PEASLEE	75	PL 57B 189	D.C. Peaslee <i>et al.</i>	(CANB, BARI, BROW+)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
COOPER	68	PRL 20 1059	W.A. Cooper <i>et al.</i>	(ANL)

NODE=M044

REFID=60256
 REFID=48828
 REFID=48327
 REFID=48349
 REFID=47432
 REFID=47950
 REFID=45212
 REFID=44103
 REFID=45210
 REFID=21838
 REFID=21837
 REFID=21964
 REFID=21733
 REFID=21963
 REFID=21830
 REFID=21824
 REFID=21813
 REFID=21807
 REFID=21805

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M107

 $f_2(2300)$ MASS

NODE=M107M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2297±28	¹ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2262± 4±28	² ABLIKIM	21AI BES3	3.51–4.60 $e^+ e^- \rightarrow \phi \Lambda \bar{\Lambda}$
2243+ 7+ 3 – 6–29	³ UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
2270±12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2327± 9± 6	ABE	04 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
2231±10	BOOTH	86 OMEG	85 $\pi^- \text{Be} \rightarrow 2\phi \text{Be}$
2220+90 –20	LINDENBAUM	84 RVUE	
2320±40	ETKIN	82 MPS	22 $\pi^- p \rightarrow 2\phi n$

NODE=M107M

¹ Includes data of ETKIN 85. The percentage of the resonance going into $\phi\phi 2^{++} S_2$,

D_2 , and D_0 is 6^{+15}_{-5} , 25^{+18}_{-14} , and 69^{+16}_{-27} , respectively.

² Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

³ Spin 2 preferred, tentatively assigned to $f_2(2300)$.

NODE=M107M;LINKAGE=C

NODE=M107M;LINKAGE=B

NODE=M107M;LINKAGE=A

 $f_2(2300)$ WIDTH

NODE=M107W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
150±40 OUR AVERAGE	[149 ± 40 MeV OUR 2023 AVERAGE]		
149±41	¹ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
72± 5±43	² ABLIKIM	21AI BES3	3.51–4.60 $e^+ e^- \rightarrow \phi \Lambda \bar{\Lambda}$
145±12+27 –34	³ UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
90±29	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
275±36±20	ABE	04 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
133±50	BOOTH	86 OMEG	85 $\pi^- \text{Be} \rightarrow 2\phi \text{Be}$
200±50	LINDENBAUM	84 RVUE	
220±70	ETKIN	82 MPS	22 $\pi^- p \rightarrow 2\phi n$

NODE=M107W

NEW

¹ Includes data of ETKIN 85.

² Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

³ Spin 2 preferred, tentatively assigned to $f_2(2300)$.

NODE=M107W;LINKAGE=C

NODE=M107W;LINKAGE=B

NODE=M107W;LINKAGE=A

 $f_2(2300)$ DECAY MODES

NODE=M107215;NODE=M107

Mode	Fraction (Γ_i/Γ)
Γ_1 $\phi\phi$	seen
Γ_2 $K\bar{K}$	seen
Γ_3 $\gamma\gamma$	seen
Γ_4 $\Lambda\bar{\Lambda}$	seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

 $f_2(2300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M107225

 $\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_3/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.2+0.5+ 1.3 –0.4– 2.2	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
44 ±6 ±12	¹ ABE	04 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

¹ Assuming spin 2.

NODE=M107G1

NODE=M107G1

NODE=M107G1;LINKAGE=AB

$f_2(2340)$ BRANCHING RATIOS

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	BOOTH	86	OMEG 85 $\pi^- \text{Be} \rightarrow 2\phi \text{Be}$	
seen	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$	

NODE=M107220

NODE=M107R01
NODE=M107R01

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	
seen	ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$	

NODE=M107R02
NODE=M107R02

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M107R03
NODE=M107R03

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ ABLIKIM	21AI	BES3 3.51–4.60 $e^+ e^- \rightarrow \phi \Lambda\bar{\Lambda}$	

NODE=M107R00
NODE=M107R00

¹ Threshold enhancement in $\Lambda\bar{\Lambda}$, preferred J^{PC} are 2^{++} , 2^{-+} , or 1^{++} . Could be another state.

NODE=M107R00;LINKAGE=A

 $f_2(2300)$ REFERENCES

ABLIKIM	21AI	PR D104 052006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)
ABE	04	Translated from YAF 69 515	K. Abe <i>et al.</i>	(BELLE Collab.)
ETKIN	88	EPJ C32 323	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH	86	PL B201 568	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN	85	NP B273 677	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	PL 165B 217	S.J. Lindenbaum	(CUNY)
ETKIN	82	CNPP 13 285	A. Etkin <i>et al.</i>	(BNL, CUNY)
		PRL 49 1620		

NODE=M107

REFID=61440
REFID=55592
REFID=51191REFID=49650
REFID=40285
REFID=21870
REFID=21871
REFID=21869
REFID=21866

NODE=M041

 $f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_0(2350)$. Contains results mostly from formation experiments. For further production experiments see the Further States entry. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $\rho_5(2350)$.

NODE=M041

 $f_4(2300)$ MASS

NODE=M041205

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 2314	HASAN	94	RVUE $\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE
~ 2300	¹ MARTIN	80C	RVUE
~ 2340	² CARTER	78B	CNTR 0.7–2.4 $\bar{p}p \rightarrow K^- K^+$
~ 2330	DULUDE	78B	OSPK 1–2 $\bar{p}p \rightarrow \pi^0 \pi^0$
~ 2310	³ CARTER	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \pi\pi$

¹ $I(J^P) = 0(4^+)$ from simultaneous analysis of $\bar{p}p \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.

³ $I(J^P) = 0(4^+)$ from amplitude analysis.

NODE=M041M1;LINKAGE=P
NODE=M041M1;LINKAGE=K
NODE=M041M1;LINKAGE=J**S-CHANNEL $\bar{p}p$ or $\bar{N}N$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2283±17	⁴ ANISOVICH	00J	SPEC
~ 2380	⁵ CUTTS	78B	CNTR 0.97–3 $\bar{p}p \rightarrow \bar{N}N$
2345±15	^{5,6} COUPLAND	77	CNTR 0.7–2.4 $\bar{p}p \rightarrow \bar{p}p$
2359± 2	^{5,7} ALSPECTOR	73	CNTR $\bar{p}p$ S channel
2375±10	ABRAMS	70	CNTR S channel $\bar{N}N$

⁴ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p}p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

NODE=M041M2
NODE=M041M2

NODE=M041M2;LINKAGE=AN

NODE=M041M2;LINKAGE=I
NODE=M041M2;LINKAGE=E
NODE=M041M2;LINKAGE=M

$\pi^- p \rightarrow \eta \pi \pi n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2330 \pm 20 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041M3
 NODE=M041M3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
2320±60 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2332 ± 15	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041M4
 NODE=M041M4
 → UNCHECKED ←

 $f_4(2300)$ WIDTH **$\bar{p} p \rightarrow \pi \pi$ or $\bar{K} K$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 278	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
~ 200	⁸ MARTIN	80C	RVUE
~ 150	⁹ CARTER	78B	CNTR 0.7–2.4 $\bar{p} p \rightarrow K^- K^+$
~ 210	¹⁰ CARTER	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \pi \pi$
⁸ $I(J^P) = 0(4^+)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.			
⁹ $I(J^P) = 0(4^+)$ from Barrelet-zero analysis.			
¹⁰ $I(J^P) = 0(4^+)$ from amplitude analysis.			

NODE=M041210

NODE=M041W1
 NODE=M041W1

NODE=M041W1;LINKAGE=P
 NODE=M041W1;LINKAGE=K
 NODE=M041W1;LINKAGE=J

S-CHANNEL $\bar{p} p$ or $\bar{N} N$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
310 ± 25	¹¹ ANISOVICH	00J	SPEC
135^{+150}_{-65}	^{12,13} COUPLAND	77	CNTR 0.7–2.4 $\bar{p} p \rightarrow \bar{p} p$
165^{+18}_{-8}	¹³ ALSPECTOR	73	CNTR $\bar{p} p$ S channel
~ 190	ABRAMS	70	CNTR S channel $\bar{N} N$
¹¹ From the combined analysis of ANISOVICH 99C and ANISOVICH 99F on $\bar{p} p \rightarrow \eta \pi^0 \pi^0$, $\pi^0 \pi^0$, $\eta \eta$, $\eta \eta'$, $\pi^+ \pi^-$.			
¹² From a fit to the total elastic cross section.			
¹³ Isospins 0 and 1 not separated.			

NODE=M041W2
 NODE=M041W2

NODE=M041W2;LINKAGE=AN

NODE=M041W2;LINKAGE=E
 NODE=M041W2;LINKAGE=I

 $\pi^- p \rightarrow \eta \pi \pi n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$235 \pm 50 \pm 40$	AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$

NODE=M041W3
 NODE=M041W3

 pp CENTRAL PRODUCTION

VALUE (MeV)	DOCUMENT ID	COMMENT
250±80 OUR ESTIMATE		
• • • We do not use the following data for averages, fits, limits, etc. • • •		
260 ± 57	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

NODE=M041W4
 NODE=M041W4
 → UNCHECKED ←

 $f_4(2300)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho \rho$	seen
Γ_2 $\omega \omega$	seen
Γ_3 $\eta \pi \pi$	seen
Γ_4 $\pi \pi$	seen
Γ_5 $K \bar{K}$	seen
Γ_6 $N \bar{N}$	seen

NODE=M041215;NODE=M041

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←

 $f_4(2300)$ BRANCHING RATIOS **$\Gamma(\rho\rho)/\Gamma(\omega\omega)$**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.8 ± 0.5	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_s$

 Γ_1/Γ_2

NODE=M041220

NODE=M041R1
 NODE=M041R1

$f_4(2300)$ REFERENCES

AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARBERIS	00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
DULUDE	78B	PL 79B 335	R.S. Dulude <i>et al.</i>	(BROW, MIT, BARI) JP
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M041

REFID=47432
REFID=47950
REFID=47962
REFID=46903
REFID=46926
REFID=44103
REFID=21838
REFID=21837
REFID=21964
REFID=21733
REFID=21850
REFID=21963
REFID=21830
REFID=21813
REFID=21807

 $f_0(2330)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE

NODE=M169

 $f_0(2330)$ MASS

NODE=M169M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$2312 \pm 7_{-3}^{+7}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
$2312 \pm 2_{-0}^{+10}$	² ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
2419 ± 64	³ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K})$
2340 ± 20	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
2314 ± 25	⁴ BUGG	04A RVUE	
2337 ± 14	ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 2321	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M169M

- ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ *P*-wave.
² From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
³ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
⁴ Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M169M;LINKAGE=C

NODE=M169M;LINKAGE=B

NODE=M169M;LINKAGE=A

NODE=M169M;LINKAGE=BU

 $f_0(2330)$ WIDTH

NODE=M169W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$65 \pm 10_{-12}^{+3}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$
$134 \pm 5_{-9}^{+30}$	² ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
274 ± 94	³ RODAS	22 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K})$
165 ± 25	SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
144 ± 20	⁴ BUGG	04A RVUE	
217 ± 33	ANISOVICH	00J SPEC	$2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 223	HASAN	94 RVUE	$\bar{p} p \rightarrow \pi \pi$

NODE=M169W

- ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ *P*-wave.
² From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.
³ T-matrix pole from coupled channel K-matrix fit to data on $J/\psi \rightarrow \gamma \pi^0 \pi^0$ (ABLIKIM 15AE) and $J/\psi \rightarrow \gamma K_S^0 K_S^0$ (ABLIKIM 18AA).
⁴ Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M169W;LINKAGE=C

NODE=M169W;LINKAGE=B

NODE=M169W;LINKAGE=A

NODE=M169W;LINKAGE=BU

$f_0(2330)$ REFERENCES

ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D107 079901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
RODAS	22	EPJ C82 80	A. Rodas <i>et al.</i>	(JPAC Collab.)
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BUGG	04A	EPJ C36 161	D.V. Bugg	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>	
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M169

REFID=61891
REFID=62033
REFID=61637
REFID=61610
REFID=61091
REFID=59455
REFID=56984
REFID=50158
REFID=47950
REFID=47965
REFID=44103

 $f_2(2340)$

$$I^G(J^{PC}) = 0^{+}(2^{+}+)$$

NODE=M108

 $f_2(2340)$ MASS

NODE=M108M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M108M

 2346^{+21}_{-10} OUR AVERAGE

$2346 \pm 8^{+22}_{-6}$		¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
$2362^{+31+140}_{-30-63}$	5.5k	² ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2339 ± 55		³ ETKIN	88	MPS	$22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2350 ± 7	80k	⁴ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
2392 ± 10		BOOTH	86	OMEG	$85 \pi^- \text{Be} \rightarrow 2 \phi \text{Be}$
2360 ± 20		LINDENBAUM	84	RVUE	

NODE=M108M;LINKAGE=B

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

² From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

³ Includes data of ETKIN 85. The percentage of the resonance going into $\phi \phi 2^{++} S_2$, D_2 , and D_0 is 37 ± 19 , 4^{+12}_{-4} , and 59^{+21}_{-19} , respectively.

⁴ Statistical error only.

NODE=M108M;LINKAGE=A

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

 $f_2(2340)$ WIDTH

NODE=M108W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M108W

 331^{+27}_{-18} OUR AVERAGE

$332 \pm 14^{+26}_{-12}$		¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
$334^{+62+165}_{-54-100}$	5.5k	² ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
319^{+81}_{-69}		³ ETKIN	88	MPS	$22 \pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
218 ± 16	80k	⁴ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
198 ± 50		BOOTH	86	OMEG	$85 \pi^- \text{Be} \rightarrow 2 \phi \text{Be}$
150^{+150}_{-50}		LINDENBAUM	84	RVUE	

NODE=M108W;LINKAGE=B

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

² From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

³ Includes data of ETKIN 85.

⁴ Statistical error only.

NODE=M108W;LINKAGE=A

NODE=M108W;LINKAGE=C

NODE=M108W;LINKAGE=ST

f₂(2340) DECAY MODES

NODE=M108215;NODE=M108

Mode		Fraction (Γ_i/Γ)
Γ_1	$\phi\phi$	seen
Γ_2	$\eta\eta$	seen
Γ_3	$\eta'\eta'$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2
DESIG=3

f₂(2340) BRANCHING RATIOS

NODE=M108220

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	Γ_2/Γ			
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	UMAN	06	E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$

NODE=M108R01
NODE=M108R01

$\Gamma(\eta'\eta')/\Gamma_{\text{total}}$	Γ_3/Γ			
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma\eta'\eta' \rightarrow 4/5\gamma 2(\pi^+\pi^-)$

NODE=M108R00
NODE=M108R00

¹ From a partial wave analysis of the systems (γX), with $X \rightarrow \eta'\eta'$, and ($\eta' X$), with $X \rightarrow \gamma\eta'$ in the decay $J/\psi \rightarrow \gamma\eta'\eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M108R00;LINKAGE=A

f₂(2340) REFERENCES

NODE=M108

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
ETKIN	88	PL B201 568	A. Etkin <i>et al.</i>	(BNL, CUNY)
BOOTH	86	NP B273 677	P.S.L. Booth <i>et al.</i>	(LIVP, GLAS, CERN)
ETKIN	85	PL 165B 217	A. Etkin <i>et al.</i>	(BNL, CUNY)
LINDENBAUM	84	CNPP 13 285	S.J. Lindenbaum	(CUNY)

REFID=61637
REFID=55387
REFID=51063
REFID=40285
REFID=21870
REFID=21871
REFID=21869

$\rho_5(2350)$

$I^G(J^{PC}) = 1^+(5^{--})$

NODE=M033

OMITTED FROM SUMMARY TABLE

This entry was previously called $U_1(2400)$. See also $\rho(2150)$, $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

NODE=M033

$\rho_5(2350)$ MASS

NODE=M033205

$\pi^- p \rightarrow \omega\pi^0 n$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
2330±35	ALDE	95	GAM2	$38 \pi^- p \rightarrow \omega\pi^0 n$

NODE=M033M3
NODE=M033M3

$\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

NODE=M033M1
NODE=M033M1

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 2303	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
~ 2300	¹ MARTIN	80B	RVUE	
~ 2250	¹ MARTIN	80C	RVUE	
~ 2500	² CARTER	78B	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow K^- K^+$
~ 2480	³ CARTER	77	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow \pi\pi$

S-CHANNEL $\bar{N}N$

NODE=M033M2
NODE=M033M2

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2300±45	⁴ ANISOVICH	02	SPEC	$0.6\text{--}1.9 \bar{p}\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2295±30	ANISOVICH	00J	SPEC	
~ 2380	⁵ CUTTS	78B	CNTR	$0.97\text{--}3 \bar{p}p \rightarrow \bar{N}N$
2345±15	^{5,6} COUPLAND	77	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
2359± 2	^{5,7} ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
2350±10	⁸ ABRAMS	70	CNTR	S channel $\bar{N}N$
2360±25	⁹ OH	70B	HDBC -0	$\bar{p}(pn), K^* K 2\pi$

$\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2307 ± 6	ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$

¹ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

² $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis.

³ $I(J^P) = 1(5^-)$ from amplitude analysis.

⁴ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

⁵ Isospins 0 and 1 not separated.

⁶ From a fit to the total elastic cross section.

⁷ Referred to as U or U region by ALSPECTOR 73.

⁸ For $I = 1 \bar{N}N$.

⁹ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.

NODE=M033M4
NODE=M033M4

NODE=M033M1;LINKAGE=P
NODE=M033M1;LINKAGE=K
NODE=M033M1;LINKAGE=J
NODE=M033M2;LINKAGE=AY

NODE=M033M2;LINKAGE=I
NODE=M033M2;LINKAGE=E
NODE=M033M2;LINKAGE=M
NODE=M033M2;LINKAGE=A
NODE=M033M2;LINKAGE=N

 $\rho_5(2350)$ WIDTH

NODE=M033210

 $\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

400 ± 100	ALDE	95	GAM2	38 $\pi^- p \rightarrow \omega \pi^0 n$

NODE=M033W3
NODE=M033W3

 $\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 169	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

~ 250	10 MARTIN	80B	RVUE	

~ 300	10 MARTIN	80C	RVUE	

~ 150	11 CARTER	78B	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow K^- K^+$

~ 210	12 CARTER	77	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \pi\pi$

NODE=M033W1
NODE=M033W1

S-CHANNEL $\bar{N}N$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

260 ± 75	13 ANISOVICH	02	SPEC	0.6-1.9 $p\bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$

235 ⁺⁶⁵ / ₋₄₀	ANISOVICH	00J	SPEC	

135 ⁺¹⁵⁰ / ₋₆₅	14,15 COUPLAND	77	CNTR	0	0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$

165 ⁺¹⁸ / ₋₈	15 ALSPECTOR	73	CNTR		$\bar{p}p$ S channel

< 60	16 OH	70B	HDBC	-0	$\bar{p}(pn), K^* K 2\pi$

~ 140	ABRAMS	67C	CNTR		S channel $\bar{p}N$

NODE=M033W2
NODE=M033W2

 $\pi^- p \rightarrow K^+ K^- n$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

245 ± 20	ALPER	80	CNTR	0	62 $\pi^- p \rightarrow K^+ K^- n$

¹⁰ $I(J^P) = 1(5^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

¹¹ $I = 0(1); J^P = 5^-$ from Barrelet-zero analysis.

¹² $I(J^P) = 1(5^-)$ from amplitude analysis.

¹³ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁴ From a fit to the total elastic cross section.

¹⁵ Isospins 0 and 1 not separated.

¹⁶ No evidence for this bump seen in the $\bar{p}p$ data of CHAPMAN 71B. Narrow state not confirmed by OH 73 with more data.

NODE=M033W4
NODE=M033W4

OCCUR=2

NODE=M033W1;LINKAGE=P
NODE=M033W1;LINKAGE=K
NODE=M033W1;LINKAGE=J
NODE=M033W2;LINKAGE=AY

NODE=M033W2;LINKAGE=E
NODE=M033W2;LINKAGE=I
NODE=M033W2;LINKAGE=N

$\rho_5(2350)$ REFERENCES

ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
ALDE	95	ZPHY C66 379	D.M. Alde <i>et al.</i>	(GAMS Collab.) JP
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
MARTIN	80B	NP B176 355	B.R. Martin, D. Morgan	(LOUC, RHEL) JP
MARTIN	80C	NP B169 216	A.D. Martin, M.R. Pennington	(DURH) JP
CARTER	78B	NP B141 467	A.A. Carter	(LOQM)
CUTTS	78B	PR D17 16	D. Cutts <i>et al.</i>	(STON, WISC)
CARTER	77	PL 67B 117	A.A. Carter <i>et al.</i>	(LOQM, RHEL) JP
COUPLAND	77	PL 71B 460	M. Coupland <i>et al.</i>	(LOQM, RHEL)
ALSPECTOR	73	PRL 30 511	J. Alspector <i>et al.</i>	(RUTG, UPNJ)
OH	73	NP B51 57	B.Y. Oh <i>et al.</i>	(MSU)
CHAPMAN	71B	PR D4 1275	J.W. Chapman <i>et al.</i>	(MICH)
ABRAMS	70	PR D1 1917	R.J. Abrams <i>et al.</i>	(BNL)
OH	70B	PRL 24 1257	B.Y. Oh <i>et al.</i>	(MSU)
ABRAMS	67C	PRL 18 1209	R.J. Abrams <i>et al.</i>	(BNL)

NODE=M033

REFID=48828
REFID=48327
REFID=48349
REFID=47950
REFID=44371
REFID=44103
REFID=21665
REFID=21838
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REFID=21733
REFID=21963
REFID=21830
REFID=21813
REFID=21931
REFID=21926
REFID=21807
REFID=21925
REFID=21804

$X(2370)$

$I^G(J^{PC}) = ?^?(??)$

NODE=M247

OMITTED FROM SUMMARY TABLE

$X(2370)$ MASS

NODE=M247M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2357 ±17 OUR AVERAGE		Error includes scale factor of 2.7.		
2341.6± 6.5±5.7		¹ ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K \bar{K} \eta'$
2376.3± 8.7 ^{+3.2} _{-4.3}	565	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M247M

¹ The state observed by ABLIKIM 11C at 2120 MeV is not observed with 90% CL upper limit of 1.49×10^{-5} for $J/\psi \rightarrow \gamma X(2120) \rightarrow \gamma K^+ K^- \eta'$ and 6.38×10^{-6} for $K_S^0 K_S^0 \eta'$.

NODE=M247M;LINKAGE=A

$X(2370)$ WIDTH

NODE=M247W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
114⁺¹²₋₁₀ OUR AVERAGE			
117±10± 8	¹ ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K \bar{K} \eta'$
83±17 ⁺⁴⁴ ₋₆	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M247W

¹ The state observed by ABLIKIM 11C at 2120 MeV is not observed with 90% CL upper limit of 1.49×10^{-5} for $J/\psi \rightarrow \gamma X(2120) \rightarrow \gamma K^+ K^- \eta'$ and 6.38×10^{-6} for $K_S^0 K_S^0 \eta'$.

NODE=M247W;LINKAGE=A

$X(2370)$ DECAY MODES

NODE=M247215;NODE=M247

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^+ K^- \eta'$	seen
Γ_2 $K_S^0 K_S^0 \eta'$	seen
Γ_3 $\pi^+ \pi^- \eta'$	seen
Γ_4 $\eta \eta \eta'$	not seen

DESIG=1

DESIG=2

DESIG=3

DESIG=4

$X(2370)$ BRANCHING RATIOS

NODE=M247225

$\Gamma(K^+ K^- \eta')/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K^+ K^- \eta'$
$\Gamma(K_S^0 K_S^0 \eta')/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

NODE=M247R01
NODE=M247R01

NODE=M247R02
NODE=M247R02

$\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M247R00
NODE=M247R00

$\Gamma(\eta\eta\eta')/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	¹ ABLIKIM	21C	BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta \eta'$
¹ ABLIKIM 21C measured $B(J/\psi(1S) \rightarrow \gamma X(2370) \rightarrow \gamma \eta \eta \eta') < 9.2 \times 10^{-6}$.				

NODE=M247R03
NODE=M247R03

NODE=M247R03;LINKAGE=A

X(2370) REFERENCES

ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20Q	EPJ C80 746	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)

NODE=M247

REFID=61030
REFID=60457
REFID=53684

NODE=M266

$f_0(2470)$

$I^G(J^{PC}) = 0^+(0^{++})$

OMITTED FROM SUMMARY TABLE

Seen by ABLIKIM 22C with a significance of 5.2σ in a partial-wave analysis of the systems (γX) , $X \rightarrow \eta' \eta'$ and $(\eta' X)$, $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$.

NODE=M266

$f_0(2470)$ MASS

NODE=M266M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2470 \pm 4_{-6}^{+4}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.			

NODE=M266M

NODE=M266M;LINKAGE=A

$f_0(2470)$ WIDTH

NODE=M266W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$75 \pm 9_{-8}^{+11}$	¹ ABLIKIM	22C	BES3 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.			

NODE=M266W

NODE=M266W;LINKAGE=C

$f_0(2470)$ DECAY MODES

NODE=M266215;NODE=M266

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta' \eta'$	seen

DESIG=1

$\Gamma(\eta' \eta')/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$
¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.				

NODE=M266R00
NODE=M266R00

NODE=M266R00;LINKAGE=A

$f_0(2470)$ REFERENCES

NODE=M266

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)

REFID=61637

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M089

NODE=M089

NODE=M089M

NODE=M089M
NEW

NODE=M089M;LINKAGE=AN

NODE=M089W

NODE=M089W
NEW

NODE=M089W;LINKAGE=AN

NODE=M089215;NODE=M089

DESIG=1

NODE=M089220

NODE=M089R1
NODE=M089R1

NODE=M089R1;LINKAGE=A

NODE=M089

REFID=47942
REFID=47950
REFID=46903
REFID=46926
REFID=47416
REFID=47472
REFID=46605
REFID=46914

REFID=21780
REFID=40288

REFID=44705

$f_6(2510)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2470±50 OUR AVERAGE	Error includes scale factor of 2.1. [2465 ± 50 MeV OUR 2023 AVERAGE Scale factor = 2.1]		
2420±30	ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
2510±30	BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2485±40	¹ ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.			

$f_6(2510)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
260±40 OUR AVERAGE	[255 ± 40 MeV OUR 2023 AVERAGE]		
270±60	ALDE	98	GAM4 100 $\pi^- p \rightarrow \pi^0 \pi^0 n$
240±60	BINON	84B	GAM2 38 $\pi^- p \rightarrow n 2\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
410±90	² ANISOVICH	00J	SPEC 1.92–2.41 $p\bar{p}$
² From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B.			

$f_6(2510)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi \pi$	(6.0±1.0) %

$f_6(2510)$ BRANCHING RATIOS

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.06±0.01	³ BINON	83C	GAM2 38 $\pi^- p \rightarrow n 4\gamma$		
³ Assuming one pion exchange and using data of BOLOTOV 74.					

$f_6(2510)$ REFERENCES

ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
ANISOVICH	99C	PL B452 173	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99J	PL B471 271	A.V. Anisovich <i>et al.</i>	
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>	
ALDE	98	EPJ A3 361	D. Alde <i>et al.</i>	(GAM4 Collab.)
Also		PAN 62 405	D. Alde <i>et al.</i>	(GAMS Collab.)
		Translated from YAF 62 446.		
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP) JP
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)
		Translated from YAF 38 1199.		
BOLOTOV	74	PL 52B 489	V.N. Bolotov <i>et al.</i>	(SERP)

STRANGE MESONS

$(S = \pm 1, C = B = 0)$

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s$, similarly for K^{*} 's

$K_0^*(700)$

$$I(J^P) = \frac{1}{2}(0^+)$$

also known as κ ; was $K_0^*(800)$

See the related review(s):

Scalar Mesons below 1 GeV

$K_0^*(700)$ T-Matrix Pole $\sqrt{s}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(630-730) - i (260-340) OUR ESTIMATE (see Fig. 64.1 in the review)			
$(702 \pm 12^{+4}_{-5}) - i (285 \pm 16^{+8}_{-13})$	¹ DANILKIN	21	RVUE Compilation
$(648 \pm 7) - i (280 \pm 16)$	² PELAEZ	20	RVUE $\pi K \rightarrow \pi K$
$(670 \pm 18) - i (295 \pm 28)$	³ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
$(764 \pm 63^{+71}_{-54}) - i (306 \pm 149^{+143}_{-85})$	⁴ ABLIKIM	11B	BES2 $1.3k J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
$(665 \pm 9) - i (268^{+21}_{-6})$	⁵ GUO	11B	RVUE
$(849 \pm 77^{+18}_{-14}) - i (256 \pm 40^{+46}_{-22})$	⁴ ABLIKIM	10E	BES2 $1.4k J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
$(663 \pm 8 \pm 34) - i (329 \pm 5 \pm 22)$	⁶ BUGG	10	RVUE S-matrix pole
$(706.0 \pm 1.8 \pm 22.8) - i (319.4 \pm 2.2 \pm 20.2)$	⁷ BONVICINI	08A	CLEO $141k D^+ \rightarrow K^- \pi^+ \pi^+$
$(841 \pm 30^{+81}_{-73}) - i (309 \pm 45^{+48}_{-72})$	⁴ ABLIKIM	06C	BES2 $25k J/\psi \rightarrow \bar{K}^{*}(892)^0 K^+ \pi^-$
$(750^{+30}_{-55}) - i (342 \pm 60)$	⁸ BUGG	06	RVUE
$(658 \pm 13) - i (279 \pm 12)$	⁹ DESCOTES-G.	06	RVUE $\pi K \rightarrow \pi K$
$(757 \pm 33) - i (279 \pm 41)$	¹⁰ GUO	06	RVUE
$(694 \pm 53) - i (303 \pm 30)$	¹¹ ZHOU	06	RVUE $K p \rightarrow K^- \pi^+ n$
$(594 \pm 79) - i (362 \pm 166)$	¹¹ ZHENG	04	RVUE $K^- p \rightarrow K^- \pi^+ n$
$(722 \pm 60) - i (386 \pm 50)$	¹¹ BUGG	03	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$(875 \pm 75) - i (335 \pm 110)$	¹² ISHIDA	97B	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$727 - i 263$	¹³ VANBEVEREN	86	RVUE

¹ Data driven analysis using partial-wave dispersion relations .

² Extracted employing πK partial wave analysis from ESTABROOKS 78 and ASTON 88, Roy-Steiner equations and once subtracted forward dispersion relations.

³ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

⁴ Extracted from Breit-Wigner parameters.

⁵ Fit to scattering phase shifts using UChPT amplitudes with explicit resonances.

⁶ Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.

⁷ From a complex pole included in the fit. Using parameters from the model that fits data best.

⁸ Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C using for the κ an s-dependent width with an Adler zero near threshold.

⁹ Using Roy-Steiner equations (ROY 71) consistent with unitarity, analyticity and crossing symmetry constraints.

¹⁰ From UChPT fitted to MERCER 71, BINGHAM 72 and ESTABROOKS 78. Amplitude shown to be consistent with data of ABLIKIM 06C.

¹¹ Reanalysis of ASTON 88 data.

¹² Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes. Extracted from Breit-Wigner parameters.

¹³ Unitarized Quark Model.

NODE=MXXX020

NODE=MXXX020

NODE=M174

NODE=M174TMP

NODE=M174TMP

→ UNCHECKED ←

NODE=M174TMP;LINKAGE=P

NODE=M174TMP;LINKAGE=J

NODE=M174TMP;LINKAGE=N

NODE=M174TMP;LINKAGE=A

NODE=M174TMP;LINKAGE=D

NODE=M174TMP;LINKAGE=H

NODE=M174TMP;LINKAGE=B

NODE=M174TMP;LINKAGE=G

NODE=M174TMP;LINKAGE=I

NODE=M174TMP;LINKAGE=O

NODE=M174TMP;LINKAGE=F

NODE=M174TMP;LINKAGE=M

NODE=M174TMP;LINKAGE=E

$K_0^*(700)$ Breit-Wigner Mass

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
845 ±17 OUR AVERAGE				
826 ±49 $^{+49}_{-34}$	1.3k	¹ ABLIKIM	11B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
810 ±68 $^{+15}_{-24}$	1.4k	² ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
856 ±17 ±13	54k	LINK	07B FOCUS	$D^+ \rightarrow K^- \pi^+ \pi^+$
878 ±23 $^{+64}_{-55}$	25k	³ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
797 ±19 ±43	15k	^{4,5} AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
888.0 ± 1.9	141k	⁶ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
855 ±15	0.6k	⁷ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
905 $^{+65}_{-30}$		⁸ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174M
NODE=M174M

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M174M;LINKAGE=LI

NODE=M174M;LINKAGE=BL

NODE=M174M;LINKAGE=EP

NODE=M174M;LINKAGE=A

NODE=M174M;LINKAGE=AU

NODE=M174M;LINKAGE=C
NODE=M174M;LINKAGE=CA

NODE=M174M;LINKAGE=IS

¹ The Breit-Wigner parameters from a fit with seven intermediate resonances. The S-matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

² From a fit including ten additional resonances and energy-independent Breit-Wigner width.

³ A fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(700)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ decay studied by EPIFANOV 07. Averaged value from different parameterizations.

⁴ Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(700)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

⁵ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

⁶ Using parameters from the model that fits data best.

⁷ Breit-Wigner parameters. A significant S-wave can be also modeled as a non-resonant contribution.

⁸ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

 $K_0^*(700)$ Breit-Wigner Width

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
468 ± 30 OUR AVERAGE				
449 ±156 $^{+144}_{-81}$	1.3k	¹ ABLIKIM	11B BES2	$J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
536 ± 87 $^{+106}_{-47}$	1.4k	² ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
464 ± 28 ± 22	54k	LINK	07B FOCUS	$D^+ \rightarrow K^- \pi^+ \pi^+$
499 ± 52 $^{+55}_{-87}$	25k	³ ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
410 ± 43 ± 87	15k	^{4,5} AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
550.4 ± 11.8	141k	⁶ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
251 ± 48	0.6k	⁷ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
545 $^{+235}_{-110}$		⁸ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174W

NODE=M174W

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M174W;LINKAGE=LI

NODE=M174W;LINKAGE=BL

NODE=M174W;LINKAGE=EP

NODE=M174W;LINKAGE=A

NODE=M174W;LINKAGE=AU

NODE=M174W;LINKAGE=C
NODE=M174W;LINKAGE=CA

NODE=M174W;LINKAGE=IS

¹ The Breit-Wigner parameters from a fit with seven intermediate resonances. The S-matrix pole position is $(764 \pm 63^{+71}_{-54}) - i(306 \pm 149^{+143}_{-85})$ MeV.

² From a fit including ten additional resonances and energy-independent Breit-Wigner width.

³ A fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model with mass and width of the $K_0^*(700)$ from ABLIKIM 06C well describes the left slope of the $K_S^0 \pi^-$ invariant mass spectrum in $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$ decay studied by EPIFANOV 07. Averaged value from different parameterizations.

⁴ Not seen by KOPP 01 using 7070 events of $D^0 \rightarrow K^- \pi^+ \pi^0$. LINK 02E and LINK 05I show clear evidence for a constant non-resonant scalar amplitude rather than $K_0^*(700)$ in their high statistics analysis of $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

⁵ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

⁶ Using parameters from the model that fits data best.

⁷ Statistical error only. A fit to the Dalitz plot including the $K_0^*(700)^\pm$, $K^*(892)^\pm$, and ϕ resonances modeled as Breit-Wigners. A significant S-wave can be also modeled as a non-resonant contribution.

⁸ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

$K^*(700)$ DECAY MODES

NODE=M174215;NODE=M174

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\pi$	100 %

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $K^*(700)$ REFERENCES

NODE=M174

DANILKIN	21	PR D103 114023	I. Danilkin, O. Deineka, M. Vanderhaeghen (MAINZ)
PELAEZ	20	PRL 124 172001	J.R. Pelaez <i>et al.</i>
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira
ABLIKIM	11B	PL B698 183	M. Ablikim <i>et al.</i> (BES II Collab.)
GUO	11B	PR D84 034005	Z.-H. Guo, J.A. Oller
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i> (BES II Collab.)
BUGG	10	PR D81 014002	D.V. Bugg (LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i> (FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i> (CLEO Collab.)
AUBERT	07T	PR D76 011102	B. Aubert <i>et al.</i> (BABAR Collab.)
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i> (BELLE Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i> (FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i> (BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i> (FNAL E791 Collab.)
Also		PR D74 059901 (errat.)	E.M. Aitala <i>et al.</i> (FNAL E791 Collab.)
BUGG	06	PL B632 471	D.V. Bugg (LOQM)
CAWLFIELD	06A	PR D74 031108	C. Cawfield <i>et al.</i> (CLEO Collab.)
DESCOTES-G...	06	EPJ C48 553	S. Descotes-Genon, B. Moussallam
GUO	06	NP A773 78	F.K. Guo <i>et al.</i>
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng
LINK	05I	PL B621 72	J.M. Link <i>et al.</i> (FNAL FOCUS Collab.)
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>
BUGG	03	PL B572 1	D.V. Bugg
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i> (FNAL E791 Collab.)
LINK	02E	PL B535 43	J.M. Link <i>et al.</i> (FNAL FOCUS Collab.)
KOPP	01	PR D63 092001	S. Kopp <i>et al.</i> (CLEO Collab.)
ISHIDA	97B	PTP 98 621	S. Ishida <i>et al.</i>
ASTON	88	NP B296 493	D. Aston <i>et al.</i> (SLAC, NAGO, CINC, INUS)
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i> (NIJM, BIEL)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i> (MCGI, CARL, DURH+)
BINGHAM	72	NP B41 1	H.H. Bingham <i>et al.</i> (International K^+ Collab.)
MERCER	71	NP B32 381	R. Mercer <i>et al.</i> (JHU)
ROY	71	PL 36B 353	S.M. Roy

REFID=62088
 REFID=60559
 REFID=57836
 REFID=53683
 REFID=58808
 REFID=53361
 REFID=53213
 REFID=53056
 REFID=52426
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 REFID=51929
 REFID=51875
 REFID=51037
 REFID=51051
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 REFID=51518
 REFID=51164
 REFID=51198
 REFID=50679
 REFID=50165
 REFID=49586
 REFID=48807
 REFID=48728
 REFID=48134
 REFID=48655
 REFID=40262
 REFID=45769
 REFID=22443
 REFID=22415
 REFID=22412
 REFID=51107

 $K^*(892)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M018

 $K^*(892)$ T-Matrix Pole $\sqrt{s}$

NODE=M018TMP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(890 ± 14) – i (26 ± 6) OUR ESTIMATE			
(890 ± 2) – i (25.6 ± 1.2)	¹ PELAEZ	20	RVUE $\pi K \rightarrow \pi K$
(892 ± 1) – i (29 ± 1)	² PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
(889 ± 13) – i (24 ± 4)	³ PELAEZ	04A	RVUE $\pi K \rightarrow \pi K$

NODE=M018TMP

→ UNCHECKED ←

OCCUR=2

- ¹ Extracted employing πK partial wave analysis from ESTABROOKS 78 and ASTON 88, Roy-Steiner equations and once subtracted forward dispersion relations.
² Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.
³ Reanalysis of data from ESTABROOKS 78 and ASTON 88 in the unitarized ChPT model.

NODE=M018TMP;LINKAGE=A

NODE=M018TMP;LINKAGE=E

NODE=M018TMP;LINKAGE=B

 $K^*(892)$ MASS

NODE=M018205

CHARGED ONLY, HADROPRODUCED

NODE=M018M1
 NODE=M018M1

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
891.67 ± 0.26 OUR AVERAGE					
892.2 ± 0.5 ± 1.7		ALBRECHT	20	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
892.6 ± 0.5	5840	BAUBILLIER	84B	HBC	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
888 ± 3		NAPIER	84	SPEC	+ 200 $\pi^- p \rightarrow 2K_S^0 X$
891 ± 1		NAPIER	84	SPEC	– 200 $\pi^- p \rightarrow 2K_S^0 X$
891.7 ± 2.1	3700	BARTH	83	HBC	+ 70 $K^+ p \rightarrow K^0 \pi^+ X$
891 ± 1	4100	TOAFF	81	HBC	– 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.8 ± 1.6		AJINENKO	80	HBC	+ 32 $K^+ p \rightarrow K^0 \pi^+ X$
890.7 ± 0.9	1800	AGUILAR...	78B	HBC	± 0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
886.6 ± 2.4	1225	BALAND	78	HBC	± 12 $\bar{p}p \rightarrow (K\pi)^\pm X$

OCCUR=2

891.7 ± 0.6	6706	COOPER	78	HBC	±	0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
891.9 ± 0.7	9000	¹ PALER	75	HBC	—	14.3 $K^- p \rightarrow (K\pi)^- X$
892.2 ± 1.5	4404	AGUILAR...	71B	HBC	—	3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
891 ± 2	1000	CRENNELL	69D	DBC	—	3.9 $K^- N \rightarrow K^0 \pi^- X$
890 ± 3.0	720	BARLOW	67	HBC	±	1.2 $\bar{p}p \rightarrow (K^0 \pi)^\pm K^\mp$
889 ± 3.0	600	BARLOW	67	HBC	±	1.2 $\bar{p}p \rightarrow (K^0 \pi)^\pm K\pi$
891 ± 2.3	620	² DEBAERE	67B	HBC	+	3.5 $K^+ p \rightarrow K^0 \pi^+ p$
891.0 ± 1.2	1700	³ WOJCICKI	64	HBC	—	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

893.6 ± 0.1 ^{+0.2} _{-0.3}	183k	ABLIKIM	19AQ	BES	±	$J/\psi \rightarrow K^+ K^- \pi^0$
895.6 ± 0.8	4k	⁴ LEES	17C	BABR		$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
893.2 ± 0.1 ± 1.0	190k	⁵ AAIJ	16N	LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
893.5 ± 1.1	27k	⁶ ABELE	99D	CBAR	±	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
890.4 ± 0.2 ± 0.5	80k	⁷ BIRD	89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
890.0 ± 2.3	800	^{2,3} CLELAND	82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
896.0 ± 1.1	3200	^{2,3} CLELAND	82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
893 ± 1	3600	^{2,3} CLELAND	82	SPEC	—	50 $K^+ p \rightarrow K_S^0 \pi^- p$
896.0 ± 1.9	380	DELFOSSSE	81	SPEC	+	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ± 2.3	187	DELFOSSSE	81	SPEC	—	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
894.2 ± 2.0	765	² CLARK	73	HBC	—	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
894.3 ± 1.5	1150	^{2,3} CLARK	73	HBC	—	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
892.0 ± 2.6	341	² SCHWEING...	68	HBC	—	5.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NODE=M018M;LINKAGE=I
 NODE=M018M;LINKAGE=D
 NODE=M018M;LINKAGE=W
 NODE=M018M1;LINKAGE=B

NODE=M018M1;LINKAGE=A
 NODE=M018M1;LINKAGE=AN
 NODE=M018M1;LINKAGE=F

NODE=M018MCT
 NODE=M018MCT

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.47 ± 0.20 ± 0.74	53k	¹ EPIFANOV	07	BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
892.0 ± 0.5		² BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 ± 0.9		^{3,4} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 ± 0.2		^{4,5} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 ± 0.9	12k	⁶ BONVICINI	02	CLEO $\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 ± 2		⁷ BARATE	99R	ALEP $\tau^- \rightarrow K^- \pi^0 \nu_\tau$

¹ From a fit in the $K_S^0(700) + K^*(892) + K^*(1410)$ model.

² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.

⁶ Calculated by us from the shift by 4.7 ± 0.9 MeV (statistical uncertainty only) reported in BONVICINI 02 with respect to the world average value from PDG 00.

⁷ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

NODE=M018MCT;LINKAGE=EF
 NODE=M018MCT;LINKAGE=BT

NODE=M018MCT;LINKAGE=BI

NODE=M018MCT;LINKAGE=NS
 NODE=M018MCT;LINKAGE=JA
 NODE=M018MCT;LINKAGE=BO

NODE=M018MCT;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
895.55 ± 0.20 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
894.68 ± 0.25 ± 0.05		¹ ABLIKIM	16F	BES3 $D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.4 ± 0.2 ± 0.2	243k	² DEL-AMO-SA..	11I	BABR $D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 ± 0.2 ± 0.3	141k	³ BONVICINI	08A	CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
895.41 ± 0.32 ^{+0.35} _{-0.43}	18k	⁴ LINK	05I	FOCS $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 ± 2		BARBERIS	98E	OMEG 450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 ± 0.5 ± 0.2		ASTON	88	LASS 11 $K^- p \rightarrow K^- \pi^+ n$
894.52 ± 0.63	25k	⁵ ATKINSON	86	OMEG 20-70 γp

NODE=M018M2
 NODE=M018M2

894.63 ± 0.76	20k	⁵ ATKINSON	86	OMEG	20-70 γp	OCCUR=2
897 ± 1	28k	EVANGELIS...	80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$	
898.4 ± 1.4	1180	AGUILAR-...	78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$	
894.9 ± 1.6		WICKLUND	78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$	
897.6 ± 0.9		BOWLER	77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- p p$	
895.5 ± 1.0	3600	MCCUBBIN	75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$	
897.1 ± 0.7	22k	⁵ PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$	
896.0 ± 0.6	10k	FOX	74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$	
896.0 ± 0.6		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$	OCCUR=2
896 ± 2		⁶ MATISON	74	HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$	
896 ± 1	3186	LEWIS	73	HBC	2.1-2.7 $K^+ p \rightarrow K \pi \pi p$	
894.0 ± 1.3		⁶ LINGLIN	73	HBC	2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$	
898.4 ± 1.3	1700	⁷ BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$	
897.9 ± 1.1	2934	⁷ AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$	
898.0 ± 0.7	5362	⁷ AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$	OCCUR=2
895 ± 1	4300	⁸ HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+ X$	
893.7 ± 2.0	10k	DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$	
894.7 ± 1.4	1040	⁷ DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
895.50 ± 0.92 ± 2.6		⁹ ADUSZKIEW...	20A	NA61	158 pp	
898.1 ± 1.0	4k	¹⁰ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$	
895.53 ± 0.17		LEES	13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$	
894.9 ± 0.5 ± 0.7	14.4k	¹¹ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$	
896.2 ± 0.3	20k	¹² AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$	
900.7 ± 1.1	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$	

¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.

² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

³ From the isobar model with a complex pole for the κ .

⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

⁵ Inclusive reaction. Complicated background and phase-space effects.

⁶ From pole extrapolation.

⁷ Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

⁸ Number of events in peak reevaluated by us.

⁹ For transverse momenta between 0.6 and 0.8 GeV/c and rapidity $0 < y < 0.5$.

¹⁰ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.

¹¹ This value comes from a fit with χ^2 of 178/117.

¹² Systematic uncertainties not estimated.

NODE=M018M2;LINKAGE=B

NODE=M018M2;LINKAGE=DE

NODE=M018M2;LINKAGE=BO

NODE=M018M2;LINKAGE=LI

NODE=M018M2;LINKAGE=I

NODE=M018M;LINKAGE=C

NODE=M018M2;LINKAGE=D

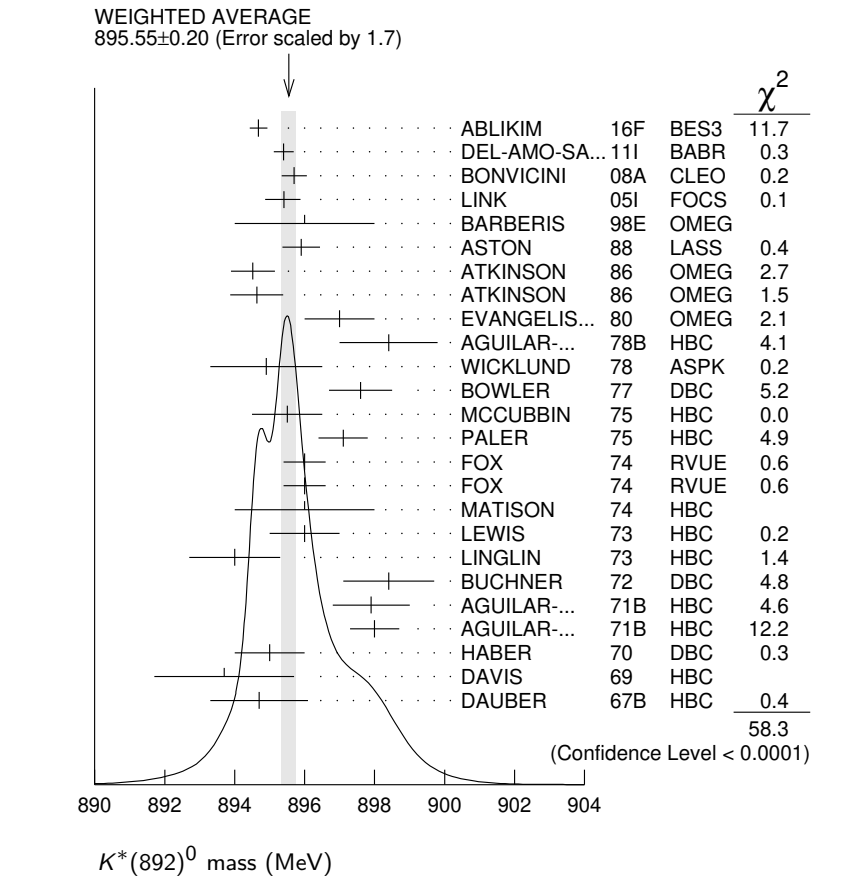
NODE=M018M2;LINKAGE=W

NODE=M018M2;LINKAGE=C

NODE=M018M2;LINKAGE=A

NODE=M018M2;LINKAGE=MI

NODE=M018M2;LINKAGE=NS



K*(892) MASSES AND MASS DIFFERENCES

Unrealistically small errors have been reported by some experiments. We use simple “realistic” tests for the minimum errors on the determination of a mass and width from a sample of N events:

$$\delta_{\min}(m) = \frac{\Gamma}{\sqrt{N}}, \quad \delta_{\min}(\Gamma) = 4 \frac{\Gamma}{\sqrt{N}} . \tag{1}$$

We consistently increase unrealistic errors before averaging. For a detailed discussion, see the 1971 edition of this Note.

$m_{K^*(892)^0} - m_{K^*(892)^\pm}$						
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
6.7±1.2 OUR AVERAGE						
7.7±1.7	2980	AGUILAR-...	78B	HBC	±0	0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
5.7±1.7	7338	AGUILAR-...	71B	HBC	−0	3.9,4.6 $K^- p$
6.3±4.1	283	¹ BARASH	67B	HBC		0.0 $\bar{p}p$
¹ Number of events in peak reevaluated by us.						

$K^*(892)$ RANGE PARAMETER						
All from partial wave amplitude analyses.						
VALUE (GeV ^{−1})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
2.1 ±0.5 ±0.5	243k	¹ DEL-AMO-SA.11I	BABR	0	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$	
3.96±0.54 ^{+1.31} _{−0.90}	18k	² LINK	05I	FOCS	0	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
3.4 ±0.7		ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
12.1 ±3.2 ±3.0		BIRD	89	LASS	−	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

¹ Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

² Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

NODE=M018R;LINKAGE=DE

NODE=M018R;LINKAGE=LI

$K^*(892)$ WIDTH

NODE=M018215

CHARGED ONLY, HADROPRODUCED

NODE=M018W1

NODE=M018W1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

51.4±0.8 OUR FIT

51.4±0.8 OUR AVERAGE

54.4±0.9±1.7		ALBRECHT	20	CBAR	0.9 $\bar{p}p \rightarrow K^+ K^- \pi^0$
49 ±2	5840	BAUBILLIER	84B	HBC	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
56 ±4		NAPIER	84	SPEC	200 $\pi^- p \rightarrow 2K_S^0 X$
51 ±2	4100	TOAFF	81	HBC	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
50.5±5.6		AJINENKO	80	HBC	32 $K^+ p \rightarrow K^0 \pi^+ X$
45.8±3.6	1800	AGUILAR-...	78B	HBC	0.76 $\bar{p}p \rightarrow K^\mp K_S^0 \pi^\pm$
52.0±2.5	6706	¹ COOPER	78	HBC	0.76 $\bar{p}p \rightarrow (K\pi)^\pm X$
52.1±2.2	9000	² PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^- X$
46.3±6.7	765	¹ CLARK	73	HBC	3.13 $K^- p \rightarrow \bar{K}^0 \pi^- p$
48.2±5.7	1150	^{1,3} CLARK	73	HBC	3.3 $K^- p \rightarrow \bar{K}^0 \pi^- p$
54.3±3.3	4404	¹ AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow (K\pi)^- p$
46 ±5	1700	^{1,3} WOJCICKI	64	HBC	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

46.7±0.2 ^{+0.1} _{-0.2}	183k	ABLIKIM	19AQ	BES	±	$J/\psi \rightarrow K^+ K^- \pi^0$
43.6±1.3	4k	⁴ LEES	17C	BABR		$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
47.2±0.3±2.3	190k	⁵ AAIJ	16N	LHCB		$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
54.8±1.7	27k	⁶ ABELE	99D	CBAR	±	0.0 $\bar{p}p \rightarrow K^+ K^- \pi^0$
45.2±1 ±2	80k	⁷ BIRD	89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
42.8±7.1	3700	BARTH	83	HBC	+	70 $K^+ p \rightarrow K^0 \pi^+ X$
64.0±9.2	800	^{1,3} CLELAND	82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
62.0±4.4	3200	^{1,3} CLELAND	82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
55 ±4	3600	^{1,3} CLELAND	82	SPEC	—	50 $K^+ p \rightarrow K_S^0 \pi^- p$
62.6±3.8	380	DELFOSE	81	SPEC	+	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
50.5±3.9	187	DELFOSE	81	SPEC	—	50 $K^\pm p \rightarrow K^\pm \pi^0 p$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

¹ Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.

² Inclusive reaction. Complicated background and phase-space effects.

³ Number of events in peak reevaluated by us.

⁴ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.

⁵ Average of fit results with different parametrizations for the $K\pi$ S -wave.

⁶ K -matrix pole.

⁷ From a partial wave amplitude analysis.

NODE=M018W;LINKAGE=D

NODE=M018W;LINKAGE=I

NODE=M018W;LINKAGE=W

NODE=M018W1;LINKAGE=B

NODE=M018W1;LINKAGE=A

NODE=M018W1;LINKAGE=AN

NODE=M018W1;LINKAGE=F

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

NODE=M018W5

NODE=M018W5

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

46.2±0.6±1.2 53k ¹ EPIFANOV 07 BELL $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$

• • • We do not use the following data for averages, fits, limits, etc. • • •

46.5±1.1		² BOITO	10	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2±0.4		^{3,4} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5±0.4		^{4,5} JAMIN	08	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 ±8		⁶ BARATE	99R	ALEP	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$

¹ From a fit in the $K_0^*(700) + K^*(892) + K^*(1410)$ model.

² From the pole position of the $K\pi$ vector form factor using EPIFANOV 07 and constraints from K_{J3} decays in ANTONELLI 10.

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

⁵ Reanalysis of EPIFANOV 07 using resonance chiral theory.

⁶ With mass and width of the $K^*(1410)$ fixed at 1412 MeV and 227 MeV, respectively.

NODE=M018W5;LINKAGE=EF

NODE=M018W5;LINKAGE=BT

NODE=M018W5;LINKAGE=BI

NODE=M018W5;LINKAGE=NS

NODE=M018W5;LINKAGE=JA

NODE=M018W5;LINKAGE=BA

NEUTRAL ONLY

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

47.3 ±0.5 OUR FIT Error includes scale factor of 2.0. [47.3 ± 0.5 MeV OUR 2023 FIT Scale factor = 1.9]

47.3 ±0.5 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.

46.53 ±0.56 ±0.31		¹ ABLIKIM	16F	BES3	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
46.5 ±0.3 ±0.2	243k	² DEL-AMO-SA..11i	BABR		$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 ±0.5 ±0.6	141k	³ BONVICINI	08A	CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 ±0.86 ^{+1.32} _{-1.06}	18k	⁴ LINK	05i	FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 ±3		BARBERIS	98E	OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 ±0.8 ±0.9		ASTON	88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
46.5 ±4.3	5900	BARTH	83	HBC	70 $K^+ p \rightarrow K^+ \pi^- X$
54 ±2	28k	EVANGELIS...	80	OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 ±4.8	1180	AGUILAR-...	78B	HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 ±1.7		WICKLUND	78	ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 ±2.5		BOWLER	77	DBC	5.4 $K^+ d \rightarrow K^+ \pi^- pp$
48 ⁺³ ₋₂	3600	MCCUBBIN	75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
50.6 ±2.5	22k	⁵ PALER	75	HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$
47 ±2	10k	FOX	74	RVUE	2 $K^- p \rightarrow K^- \pi^+ n$
51 ±2		FOX	74	RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$
46.0 ±3.3	3186	⁶ LEWIS	73	HBC	2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 ±5.0	1700	⁶ BUCHNER	72	DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
55.8 ^{+4.2} _{-3.4}	2934	⁶ AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
48.5 ±2.7	5362	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ \pi^- p$
54.0 ±3.3	4300	^{6,7} HABER	70	DBC	3 $K^- N \rightarrow K^- \pi^+ X$
53.2 ±2.1	10k	⁶ DAVIS	69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 ±5.5	1040	⁶ DAUBER	67B	HBC	2.0 $K^- p \rightarrow K^- \pi^+ \pi^- p$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
48.8 ±1.8 ±2.0		⁸ ADUSZKIEW...20A	NA61	158	pp
52.6 ±1.7	4k	⁹ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
44.90 ±0.30		LEES	13F	BABR	$D^+ \rightarrow K^+ K^- \pi^+$
45.7 ±1.1 ±0.5	14.4k	¹⁰ MITCHELL	09A	CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 ±0.9	20k	¹¹ AUBERT	07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$

¹ Taking also into account the $K_0^*(1430)^0$ and $K_2^*(1430)^0$.

² Taking into account the $K^*(892)^0$, S -wave and P -wave ($K^*(1410)^0$).

³ From the isobar model with a complex pole for the κ .

⁴ Fit to $K\pi$ mass spectrum includes a non-resonant scalar component.

⁵ Inclusive reaction. Complicated background and phase-space effects.

⁶ Width errors enlarged by us to $4 \times \Gamma/\sqrt{N}$; see note.

⁷ Number of events in peak reevaluated by us.

⁸ For transverse momenta between 0.6 and 0.8 GeV/c and rapidity $0 < y < 0.5$.

⁹ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.

¹⁰ This value comes from a fit with χ^2 of 178/117.

¹¹ Systematic uncertainties not estimated.

NODE=M018W2

NODE=M018W2

NEW

OCCUR=2

OCCUR=2

NODE=M018W2;LINKAGE=B

NODE=M018W2;LINKAGE=DE

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NODE=M018W2;LINKAGE=I

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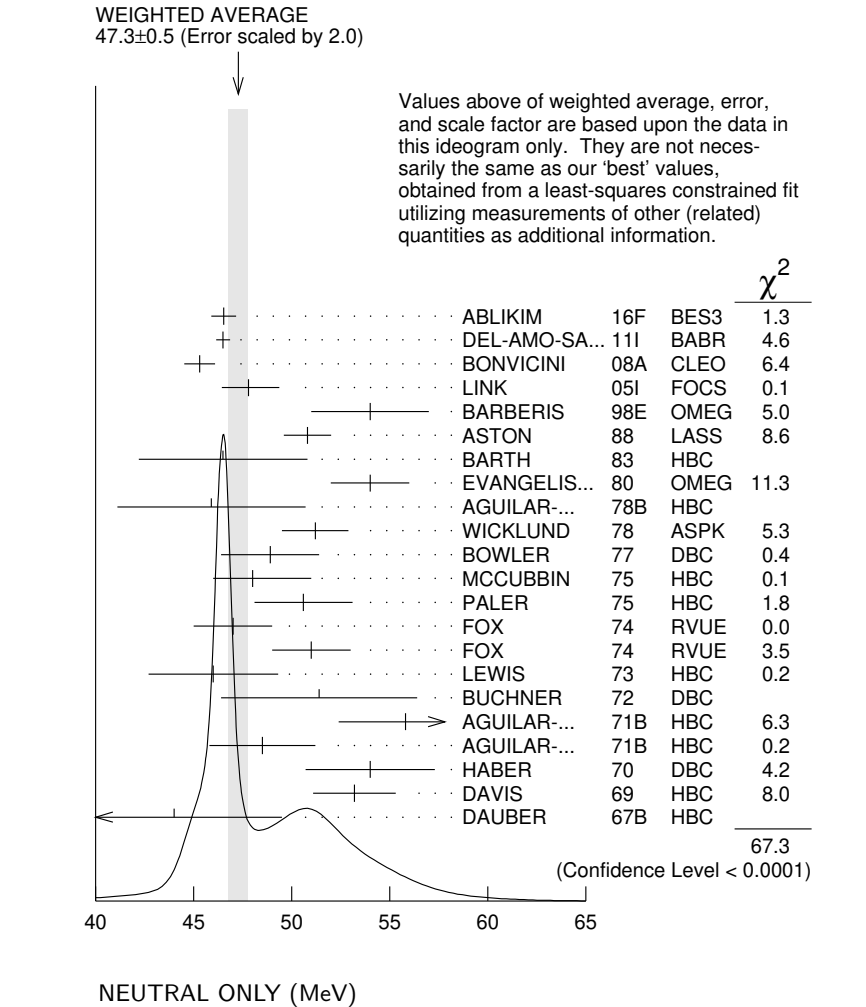
NODE=M018W2;LINKAGE=W

NODE=M018W2;LINKAGE=C

NODE=M018W2;LINKAGE=A

NODE=M018W2;LINKAGE=MI

NODE=M018W2;LINKAGE=NS



K*(892) DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\pi$	~ 100	%
Γ_2 $(K\pi)^\pm$	$(99.902 \pm 0.009) \%$	
Γ_3 $(K\pi)^0$	$(99.754 \pm 0.021) \%$	
Γ_4 $K^0\gamma$	$(2.46 \pm 0.21) \times 10^{-3}$	
Γ_5 $K^\pm\gamma$	$(9.8 \pm 0.9) \times 10^{-4}$	
Γ_6 $K\pi\pi$	$< 7 \times 10^{-4}$	95%

NODE=M018220;NODE=M018

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=11
DESIG=12
DESIG=4
DESIG=3
DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 14 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 10.7$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	Γ	$\begin{vmatrix} -100 & 17 \\ 17 & -17 \end{vmatrix}$	x_2	x_5
Mode	Rate (MeV)			
Γ_2 $(K\pi)^\pm$	51.4 ± 0.8			
Γ_5 $K^\pm\gamma$	0.050 ± 0.005			

DESIG=11
DESIG=3

CONSTRAINED FIT INFORMATION

An overall fit to the total width and a partial width uses 23 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 68.4$ for 21 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_4	-100	
Γ	13	-13
	x_3	x_4

	Mode	Rate (MeV)	Scale factor
Γ_3	$(K\pi)^0$	47.2 $\pm$ 0.5	2.0
Γ_4	$K^0\gamma$	0.117 $\pm$ 0.010	

DESIG=12

DESIG=4

$K^*(892)$ PARTIAL WIDTHS

NODE=M018225

$\Gamma(K^0\gamma)$						Γ_4
VALUE (keV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
116 $\pm$ 10 OUR FIT						
116.5 $\pm$ 9.9	584	CARLSMITH	86	SPEC	0	$K_L^0 A \rightarrow K_S^0 \pi^0 A$

NODE=M018W4
NODE=M018W4

$\Gamma(K^\pm\gamma)$						Γ_5
VALUE (keV)		DOCUMENT ID	TECN	CHG	COMMENT	
50 $\pm$ 5 OUR FIT						
50 $\pm$ 5 OUR AVERAGE						
48 $\pm$ 11		BERG	83	SPEC	-	156 $K^- A \rightarrow \bar{K} \pi A$
51 $\pm$ 5		CHANDLEE	83	SPEC	+	200 $K^+ A \rightarrow K \pi A$

NODE=M018W3
NODE=M018W3

$K^*(892)$ BRANCHING RATIOS

NODE=M018230

$\Gamma(K^0\gamma)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE (units 10^{-3})		DOCUMENT ID	TECN	CHG	COMMENT	
2.46 $\pm$ 0.21 OUR FIT						
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.5 $\pm$ 0.7		CARITHERS	75B	CNTR	0	8-16 $\bar{K}^0 A$

NODE=M018R3
NODE=M018R3

$\Gamma(K^\pm\gamma)/\Gamma_{\text{total}}$						Γ_5/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
0.98 $\pm$ 0.09 OUR FIT						
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.6	95	BEMPORAD	73	CNTR	+	10-16 $K^+ A$

NODE=M018R2
NODE=M018R2

$\Gamma(K\pi\pi)/\Gamma((K\pi)^\pm)$						Γ_6/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
< 7 $\times 10^{-4}$	95	JONGEJANS	78	HBC	4 $K^- p \rightarrow p \bar{K}^0 2\pi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<20 $\times 10^{-4}$		WOJCICKI	64	HBC	-	1.7 $K^- p \rightarrow \bar{K}^0 \pi^- p$

NODE=M018R1
NODE=M018R1

$K^*(892)$ REFERENCES

NODE=M018

ADUSZKIEW... 20A	EPJ C80 460	A. Aduszkiewicz <i>et al.</i>	(CERN NA61 Collab.)
ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
PELAEZ 20	PRL 124 172001	J.R. Pelaez <i>et al.</i>	
ABLIKIM 19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES 17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PELAEZ 17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
AAIJ 16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM 16F	PR D94 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES 13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
DEL-AMO-SA... 11I	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
ANTONELLI 10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)
BOITO 10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)
BOITO 09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	

REFID=60631
REFID=60439
REFID=60559
REFID=59909
REFID=57981
REFID=57836
REFID=57273
REFID=57307
REFID=55127
REFID=16493
REFID=53448
REFID=53632
REFID=52728

MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52756
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=52426
JAMIN	08	PL B664 78	M. Jamin, A. Pich, J. Portoles		REFID=52285
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)	REFID=51929
LINK	05I	PL B621 72	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)	REFID=50679
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
BONVICINI	02	PRL 88 111803	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=48701
PDG	00	EPJ C15 1	D.E. Groom <i>et al.</i>	(PDG Collab.)	REFID=47469
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
BARATE	99R	EPJ C11 599	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=47366
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46348
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ATKINSON	86	ZPHY C30 521	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20564
CARLSMITH	86	PRL 56 18	D. Carlsmith <i>et al.</i>	(EFI, SACL)	REFID=22461
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
NAPIER	84	PL 149B 514	A. Napier <i>et al.</i>	(TUFTS, ARIZ, FNAL, FLOR+)	REFID=22460
BARTH	83	NP B223 296	M. Barth <i>et al.</i>	(BRUX, CERN, GENO, MONS+)	REFID=22456
BERG	83	Thesis UMI 83-21652	D.M. Berg	(ROCH)	REFID=22457
CHANDLEE	83	PRL 51 168	C. Chandlee <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=22458
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
DELFOSSSE	81	NP B183 349	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
AJINENKO	80	ZPHY C5 177	I.V. Ajinenko <i>et al.</i>	(SERP, BRUX, MONS+)	REFID=22449
EVANGELIS...	80	NP B165 383	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=22450
AGUILAR-...	78B	NP B141 101	M. Aguilar-Benitez <i>et al.</i>	(MADR, TATA+)	REFID=22438
BALAND	78	NP B140 220	J.F. Baland <i>et al.</i>	(MONS, BELG, CERN+)	REFID=20369
COOPER	78	NP B136 365	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=22441
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
Also			P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJH+)	REFID=22445
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)	REFID=22437
CARITHERS	75B	PRL 35 349	W.C.J. Carithers <i>et al.</i>	(ROCH, MCGI)	REFID=22433
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)	REFID=22434
PALER	75	NP B96 1	K. Paler <i>et al.</i>	(RHEL, SACL, EPOL)	REFID=22435
FOX	74	NP B80 403	G.C. Fox, M.L. Griss	(CIT)	REFID=22430
MATISON	74	PR D9 1872	M.J. Matison <i>et al.</i>	(LBL)	REFID=22431
BEMPORAD	73	NP B51 1	C. Bemporad <i>et al.</i>	(CERN, ETH, LOIC)	REFID=22416
CLARK	73	NP B54 432	A.G. Clark, L. Lyons, D. Radojicic	(OXF)	REFID=22426
LEWIS	73	NP B60 283	P.H. Lewis <i>et al.</i>	(LOWC, LOIC, CDEF)	REFID=22427
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
BUCHNER	72	NP B45 333	K. Buchner <i>et al.</i>	(MPIM, CERN, BRUX)	REFID=22418
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)	REFID=22408
HABER	70	NP B17 289	B. Haber <i>et al.</i>	(REHO, SACL, BGNA, EPOL)	REFID=22406
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)	REFID=22399
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)	REFID=22400
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)	REFID=22398
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)	REFID=20160
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)	REFID=20041
DAUBER	67B	PR 153 1403	P.M. Dauber <i>et al.</i>	(UCLA)	REFID=22389
DEBAERE	67B	NC 51A 401	W. de Baere <i>et al.</i>	(BRUX, CERN)	REFID=22390
WOJCICKI	64	PR 135 B484	S.G. Wojcicki	(LRL)	REFID=22379

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M028

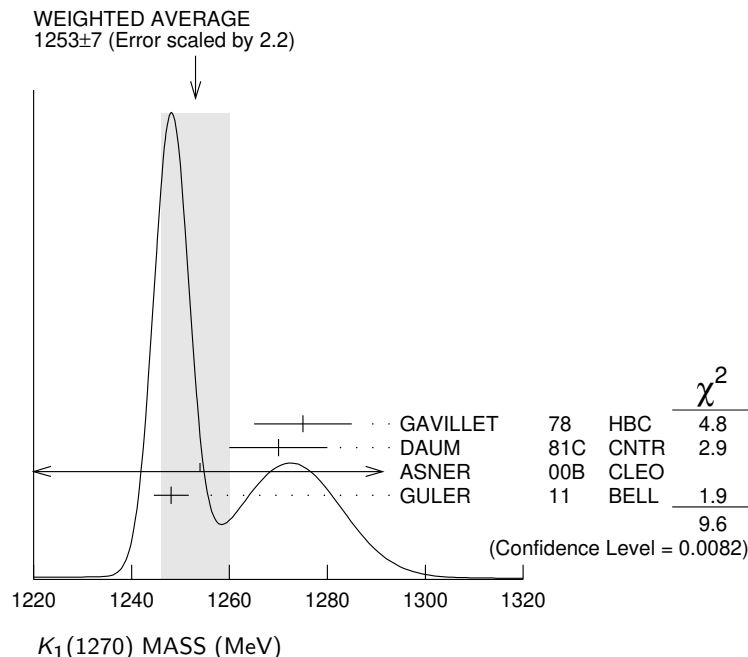
 $K_1(1270)$ MASS

NODE=M028MX

NODE=M028MX

VALUE (MeV) DOCUMENT ID

1253±7 OUR AVERAGE Includes data from the 4 datablocks that follow this one. Error includes scale factor of 2.2. See the ideogram below.

**PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE**

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

1275±10 700 GAVILLET 78 HBC + 4.2 $K^- p \rightarrow \Xi^- (K\pi\pi)^+$

NODE=M028M2
NODE=M028M2**PRODUCED BY K BEAMS**

VALUE (MeV) DOCUMENT ID TECN CHG COMMENT

The data in this block is included in the average printed for a previous datablock.

1270±10 ¹ DAUM 81C CNTR - 63 $K^- p \rightarrow K^- 2\pi p$
 • • • We do not use the following data for averages, fits, limits, etc. • • •
 ~ 1276 ² TORNQVIST 82B RVUE
 ~ 1300 VERGEEST 79 HBC - 4.2 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$
 1289±25 ³ CARNEGIE 77 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
 ~ 1300 BRANDENB... 76 ASPK ± 13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
 ~ 1270 OTTER 76 HBC - 10,14,16 $K^- p \rightarrow (\bar{K}\pi\pi)^- p$
 1260 DAVIS 72 HBC + 12 $K^+ p$
 1234±12 FIRESTONE 72B DBC + 12 $K^+ d$

NODE=M028M3
NODE=M028M3

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.

² From a unitarized quark-model calculation.

³ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028M3;LINKAGE=DA

NODE=M028M3;LINKAGE=T
NODE=M028M3;LINKAGE=E**PRODUCED BY BEAMS OTHER THAN K MESONS**

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

The data in this block is included in the average printed for a previous datablock.

1248.1 ± 3.3 ± 1.4 GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

NODE=M028M1
NODE=M028M1

• • • We do not use the following data for averages, fits, limits, etc. • • •

1289.81 ± 0.56 ± 1.66	894k	AAIJ	18A	LHCB	$D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
1279 ± 10	25k	¹ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
1294 ± 10	310	RODEBACK	81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$
1300	40	CRENNELL	72	HBC	$4.5 \pi^- p \rightarrow \Lambda K 2\pi$
1242 + 9 - 10		² ASTIER	69	HBC	$\bar{p} p$
1300	45	CRENNELL	67	HBC	$6 \pi^- p \rightarrow \Lambda K 2\pi$

¹ Systematic errors not estimated.
² This was called the C meson.

NODE=M028M1;LINKAGE=AB
NODE=M028M1;LINKAGE=A

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M028MT
NODE=M028MT

1250 ± 50 OUR AVERAGE	[1254 ± 50 MeV OUR 2023 AVERAGE]				
1254 ± 33 ± 34	7k	ASNER	00B	CLEO	$\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

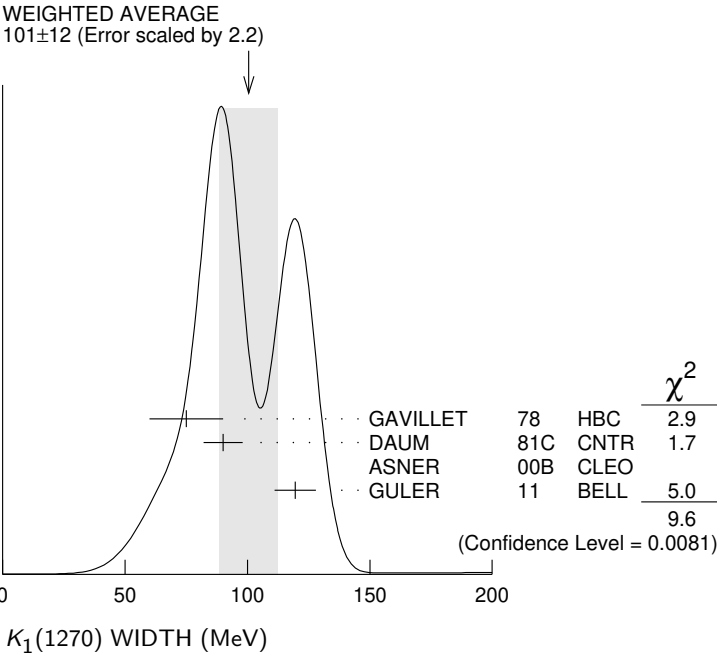
NEW

$K_1(1270)$ WIDTH

NODE=M028WX

VALUE (MeV)	DOCUMENT ID
90 ± 20 OUR ESTIMATE	This is only an educated guess; the error given is larger than the error on the average of the published values.
101 ± 12 OUR AVERAGE	Includes data from the 4 datablocks that follow this one. Error includes scale factor of 2.2. See the ideogram below.

NODE=M028WX
→ UNCHECKED ←



PRODUCED BY K^- , BACKWARD SCATTERING, HYPERON EXCHANGE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M028W2
NODE=M028W2

75 ± 15	700	GAVILLET	78	HBC	+ 4.2 $K^- p \rightarrow \Xi^- K \pi \pi$

PRODUCED BY K BEAMS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M028W3
NODE=M028W3

90 ± 8	¹ DAUM	81C	CNTR	-	63 $K^- p \rightarrow K^- 2\pi p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 150	VERGEEST	79	HBC	-	4.2 $K^- p \rightarrow (\bar{K} \pi \pi)^- p$
150 ± 71	² CARNEGIE	77	ASPK	±	13 $K^\pm p \rightarrow (K \pi \pi)^\pm p$
~ 200	BRANDENB...	76	ASPK	±	13 $K^\pm p \rightarrow (K \pi \pi)^\pm p$
120	DAVIS	72	HBC	+	12 $K^+ p$
188 ± 21	FIRESTONE	72B	DBC	+	12 $K^+ d$

¹ Well described in the chiral unitary approach of GENG 07 with two poles at 1195 and 1284 MeV and widths of 246 and 146 MeV, respectively.
² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

NODE=M028W3;LINKAGE=DA
NODE=M028W3;LINKAGE=E

PRODUCED BY BEAMS OTHER THAN K MESONS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M028W1
 NODE=M028W1

119.5 ± 5.2 ± 6.7GULER 11 BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

116.11 ± 1.65 ± 2.96	894k	AAIJ	18A	LHCB	$D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
131 ± 21	25k	¹ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
66 ± 15	310	RODEBACK	81	HBC	$4 \pi^- p \rightarrow \Lambda K 2\pi$
60	40	CRENNELL	72	HBC	$4.5 \pi^- p \rightarrow \Lambda K 2\pi$
127 $\begin{smallmatrix} +7 \\ -25 \end{smallmatrix}$		ASTIER	69	HBC	$\bar{p} p$
60	45	CRENNELL	67	HBC	$6 \pi^- p \rightarrow \Lambda K 2\pi$

¹ Systematic errors not estimated.

NODE=M028W1;LINKAGE=AB

PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M028WT
 NODE=M028WT

260 $\begin{smallmatrix} +90 \\ -70 \end{smallmatrix}$ ± 80

7k

ASNER

00B

CLEO

±

 $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$ **$K_1(1270)$ DECAY MODES**

NODE=M028215;NODE=M028

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 $K \rho$	(38 ± 13) %	2.2
Γ_2 $K_0^*(1430) \pi$	(28 ± 4) %	
Γ_3 $K^*(892) \pi$	(21 ± 10) %	2.2
Γ_4 $K \omega$	(11.0 ± 2.0) %	
Γ_5 $K f_0(1370)$	(3.0 ± 2.0) %	
Γ_6 γK^0	seen	

DESIG=2

DESIG=7

DESIG=1

DESIG=5

DESIG=8

DESIG=9;OUR EST;→ UNCHECKED ←

 $K_1(1270)$ PARTIAL WIDTHS

NODE=M028220

 $\Gamma(K \rho)$ **Γ_1**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

57 ± 5	MAZZUCATO	79	HBC	+	$4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
75 ± 6	CARNEGIE	77B	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

NODE=M028W5
 NODE=M028W5

 $\Gamma(K_0^*(1430) \pi)$ **Γ_2**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

26 ± 6	CARNEGIE	77B	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

NODE=M028W7
 NODE=M028W7

 $\Gamma(K^*(892) \pi)$ **Γ_3**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

14 ± 11	MAZZUCATO	79	HBC	+	$4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
2 ± 2	CARNEGIE	77B	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

NODE=M028W4
 NODE=M028W4

 $\Gamma(K \omega)$ **Γ_4**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

4 ± 4	MAZZUCATO	79	HBC	+	$4.2 K^- p \rightarrow \Xi^- (K \pi \pi)^+$
24 ± 3	CARNEGIE	77B	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

NODE=M028W6
 NODE=M028W6

 $\Gamma(K f_0(1370))$ **Γ_5**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

22 ± 5	CARNEGIE	77B	ASPK	±	$13 K^\pm p \rightarrow (K \pi \pi)^\pm p$

NODE=M028W8
 NODE=M028W8

$\Gamma(\gamma K^0)$ Γ_6

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

 $73.2 \pm 6.1 \pm 28.3$

ALAVI-HARATI02B

KTEV

 $K + A \rightarrow K^* + A$ NODE=M028W9
NODE=M028W9 $K_1(1270)$ BRANCHING RATIOS

NODE=M028225

 $\Gamma(K\rho)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.38 ± 0.13 OUR FIT

Error includes scale factor of 2.2.

0.42 ± 0.06¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.584 ± 0.043

² GULER

11

BELL

 $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

dominant

RODEBACK

81

HBC

 $4 \pi^- p \rightarrow \Lambda K 2\pi$ NODE=M028R2
NODE=M028R2 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.28 ± 0.04¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0201 ± 0.0064

² GULER

11

BELL

 $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$ NODE=M028R4
NODE=M028R4 $\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.21 ± 0.10 OUR FIT

Error includes scale factor of 2.2.

0.16 ± 0.05¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.171 ± 0.023

² GULER

11

BELL

 $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$ NODE=M028R1
NODE=M028R1 $\Gamma(K^*(892)\pi)/\Gamma(K\rho)$ Γ_3/Γ_1

VALUE

DOCUMENT ID

TECN

COMMENT

0.56 ± 0.29 OUR FIT

Error includes scale factor of 2.2.

0.99 ± 0.15 ± 0.18

ABLIKIM

21U

BES3

 $D_s^+ \rightarrow \bar{K}_1(1270)^0 K^+$ NODE=M028R00
NODE=M028R00 $\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.11 ± 0.02¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.225 ± 0.052

² GULER

11

BELL

 $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$ NODE=M028R3
NODE=M028R3 $\Gamma(K\omega)/\Gamma(K\rho)$ Γ_4/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.30

95

RODEBACK

81

HBC

 $4 \pi^- p \rightarrow \Lambda K 2\pi$ NODE=M028R6
NODE=M028R6 $\Gamma(K f_0(1370))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.03 ± 0.02¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$ NODE=M028R5
NODE=M028R5 D -wave/ S -wave RATIO FOR $K_1(1270) \rightarrow K^*(892)\pi$ NODE=M028R9
NODE=M028R9

VALUE

DOCUMENT ID

TECN

COMMENT

1.0 ± 0.7¹ DAUM

81C

CNTR

 $63 K^- p \rightarrow K^- 2\pi p$ ¹ Average from low and high t data.² Assuming that decays are saturated by the $K\rho$, $K_0^*(1430)\pi$, $K^*(892)\pi$, $K\omega$ decay modes and neglecting interference between them. The values $B(\omega \rightarrow \pi^+ \pi^-) = (1.53^{+0.11}_{-0.13})\%$ and $B(K_0^*(1430) \rightarrow K\pi) = (93 \pm 10)\%$ are used. Systematic uncertainties not estimated.NODE=M028R;LINKAGE=F
NODE=M028R1;LINKAGE=GU

$K_1(1270)$ REFERENCES

ABLIKIM	21U	PR D104 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	18A1	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)
GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
GENG	07	PR D75 014017	L.S. Geng <i>et al.</i>	
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
RODEBACK	81	ZPHY C9 9	S. Rodeback <i>et al.</i>	(CERN, CDEF, MADR+)
MAZZUCATO	79	NP B156 532	M. Mazzucato <i>et al.</i>	(CERN, ZEEM, NIJM+)
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)
GAVILLET	78	PL 76B 517	P. Gavillet <i>et al.</i>	(AMST, CERN, NIJM+)
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)
CARNEGIE	77B	PL 68B 287	R.K. Carnegie <i>et al.</i>	(SLAC)
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP
OTTER	76	NP B106 77	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP
CRENNELL	72	PR D6 1220	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
ASTIER	69	NP B10 65	A. Astier <i>et al.</i>	(CDEF, CERN, IPNP, LIVP) IJP
CRENNELL	67	PRL 19 44	D.J. Crennell <i>et al.</i>	(BNL) I

NODE=M028

REFID=61155
REFID=59187
REFID=53668
REFID=51623
REFID=51037
REFID=48822
REFID=47766
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REFID=22535
REFID=22536
REFID=22532
REFID=22533
REFID=22419
REFID=22505
REFID=22506
REFID=22482
REFID=22473

 $K_1(1400)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M064

 $K_1(1400)$ MASS

NODE=M064M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1403± 7 OUR AVERAGE					
1463±64±68	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
1373±14±18		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1392±18		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
1410±25		DAUM	81C	CNTR	— $63 K^- p \rightarrow K^- 2\pi p$
1415±15		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1404±10		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1418± 8	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 1350		⁴ TORNQVIST	82B	RVUE	
~ 1400		VERGEEST	79	HBC	— $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 1400		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
1420		DAVIS	72	HBC	+ $12 K^+ p$
1368±18		FIRESTONE	72B	DBC	+ $12 K^+ d$

¹ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.³ Systematic errors not estimated.⁴ From a unitarized quark-model calculation.

NODE=M064M;LINKAGE=P
NODE=M064M;LINKAGE=E
NODE=M064M;LINKAGE=AB
NODE=M064M;LINKAGE=T

 $K_1(1400)$ WIDTH

NODE=M064W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
174± 13 OUR AVERAGE Error includes scale factor of 1.6. See the ideogram below.					
$300^{+370}_{-110} \pm 140$	7k	ASNER	00B	CLEO	± $\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$
188± 54± 60		¹ ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
276± 65		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 \pi^+ \pi^- n$
195± 25		DAUM	81C	CNTR	— $63 K^- p \rightarrow K^- 2\pi p$
180± 10		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
142± 16		² CARNEGIE	77	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
152± 16	25k	³ ABLIKIM	06C	BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
~ 200		VERGEEST	79	HBC	— $4.2 K^- p \rightarrow (\bar{K}\pi\pi)^- p$
~ 160		BRANDENB...	76	ASPK	± $13 K^\pm p \rightarrow (K\pi\pi)^\pm p$
80		DAVIS	72	HBC	+ $12 K^+ p$
241± 30		FIRESTONE	72B	DBC	+ $12 K^+ d$

NODE=M064W

¹ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.

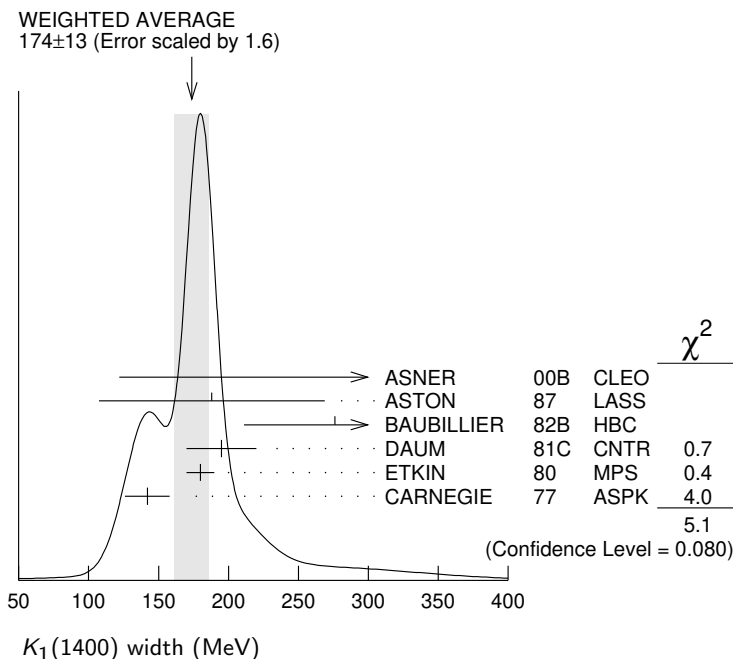
² From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.

³ Systematic errors not estimated.

NODE=M064W;LINKAGE=P

NODE=M064W;LINKAGE=E

NODE=M064W;LINKAGE=AB



$K_1(1400)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	(94 ± 6) %
Γ_2 $K\rho$	(3.0±3.0) %
Γ_3 $K f_0(1370)$	(2.0±2.0) %
Γ_4 $K\omega$	(1.0±1.0) %
Γ_5 $K_0^*(1430)\pi$	not seen
Γ_6 γK^0	seen
Γ_7 $K\phi$	seen

NODE=M064215;NODE=M064

DESIG=1

DESIG=2

DESIG=8

DESIG=5

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=10

$K_1(1400)$ PARTIAL WIDTHS

$\Gamma(K^*(892)\pi)$					Γ_1
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
117±10	CARNEGIE	77	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\rho)$					Γ_2
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
2±1	CARNEGIE	77	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(K\omega)$					Γ_4
VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT	
23±12	CARNEGIE	77	ASPK	±	13 $K^\pm p \rightarrow (K\pi\pi)^\pm p$
$\Gamma(\gamma K^0)$					Γ_6
VALUE (keV)	DOCUMENT ID	TECN	COMMENT		
280 ± 50 OUR AVERAGE	[281 ± 50 keV OUR 2023 AVERAGE]				
280.8±23.2±40.4	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$		

NODE=M064220

NODE=M064W1
NODE=M064W1

NODE=M064W2
NODE=M064W2

NODE=M064W5
NODE=M064W5

NODE=M064W6
NODE=M064W6
NEW

$K_1(1400)$ BRANCHING RATIOS

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.94±0.06	¹ DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	

¹ Average from low and high t data.

NODE=M064225

NODE=M064R1
NODE=M064R1

NODE=M064R1;LINKAGE=F

$\Gamma(K\rho)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.03±0.03	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_2/Γ

NODE=M064R2
 NODE=M064R2

NODE=M064R2;LINKAGE=F

 $\Gamma(K\phi(1370))/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.02±0.02	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_3/Γ

NODE=M064R5
 NODE=M064R5

NODE=M064R5;LINKAGE=F

 $\Gamma(K\omega)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.01±0.01	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_4/Γ

NODE=M064R3
 NODE=M064R3

NODE=M064R3;LINKAGE=F

 $\Gamma(K\phi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi \phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 9.2 σ . Γ_7/Γ

NODE=M064R00
 NODE=M064R00

NODE=M064R00;LINKAGE=A

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data. Γ_5/Γ

NODE=M064R4
 NODE=M064R4

NODE=M064R4;LINKAGE=F

D-wave/S-wave RATIO FOR $K_1(1400) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
0.04±0.01	¹ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

¹ Average from low and high t data.

NODE=M064R9
 NODE=M064R9

NODE=M064R9;LINKAGE=F

 $K_1(1400)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
ASNER	00B	PR D62 072006	D.M. Asner <i>et al.</i>	(CLEO Collab.)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
VERGEEST	79	NP B158 265	J.S.M. Vergeest <i>et al.</i>	(NIJM, AMST, CERN+)
CARNEGIE	77	NP B127 509	R.K. Carnegie <i>et al.</i>	(SLAC)
BRANDENB...	76	PRL 36 703	G.W. Brandenburg <i>et al.</i>	(SLAC) JP
DAVIS	72	PR D5 2688	P.J. Davis <i>et al.</i>	(LBL)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)

NODE=M064

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 REFID=48822
 REFID=47766
 REFID=40234
 REFID=22551
 REFID=20573
 REFID=22548
 REFID=22545
 REFID=22542
 REFID=22535
 REFID=22532
 REFID=22505
 REFID=22506

$K^*(1410)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M094

 $K^*(1410)$ T-MATRIX POLE $\sqrt{s}$ Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1368 ± 38) - i (106⁺⁴⁸₋₅₉) OUR ESTIMATE			
(1368 ± 38) - i (106 ⁺⁴⁸ ₋₅₉)	¹ PELAEZ	17 RVUE	$\pi K \rightarrow \pi K$

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M094PP

NODE=M094PP

NODE=M094PP

→ UNCHECKED ←
OCCUR=2

NODE=M094PP;LINKAGE=B

 $K^*(1410)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1414 ± 15 OUR AVERAGE		Error includes scale factor of 1.3.			
1380 ± 21 ± 19		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1420 ± 7 ± 10		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1437 ± 8 ± 16	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
1426 ± 8 ± 24	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
1276 ⁺⁷² ₋₇₇		^{3,4} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
1367 ± 54		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1474 ± 25		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
1500 ± 30		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ Using a parametrization for the $K\pi$ S-wave similar to ASTON 88 with fixed resonance width.

² Using a $K\pi$ S-wave parametrization with resonant and non-resonant contributions.

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

⁴ Systematic uncertainties not estimated.

NODE=M094M

NODE=M094M

OCCUR=2

NODE=M094M;LINKAGE=A

NODE=M094M;LINKAGE=C
NODE=M094M;LINKAGE=BI

NODE=M094M;LINKAGE=NS

 $K^*(1410)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
232 ± 21 OUR AVERAGE		Error includes scale factor of 1.1.			
176 ± 52 ± 22		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
240 ± 18 ± 12		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
210 ± 20 ± 60	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow (K_S^0 \pi^\mp) K^\pm$
270 ± 20 ± 40	190k	¹ AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 (K^\pm \pi^\mp)$
198 ⁺⁶¹ ₋₈₇		^{2,3} BOITO	09	RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
114 ± 101		BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
275 ± 65		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow \bar{K}^0 2\pi n$
500 ± 100		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

¹ Using a $K\pi$ S-wave parametrization with resonant and non-resonant contributions.

² From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

³ Systematic uncertainties not estimated.

NODE=M094W

NODE=M094W

OCCUR=2

NODE=M094W;LINKAGE=A
NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

 $K^*(1410)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K^*(892)\pi$	> 40 %	95%
Γ_2 $K\pi$	(6.6 ± 1.3) %	
Γ_3 $K\rho$	< 7 %	95%
Γ_4 γK^0	< 2.3 × 10 ⁻⁴	90%
Γ_5 $K\phi$	seen	

NODE=M094215;NODE=M094

DESIG=2

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

DESIG=5

$K^*(1410)$ PARTIAL WIDTHS

NODE=M094217

 $\Gamma(\gamma K^0)$ Γ_4

VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$

NODE=M094W1
NODE=M094W1 **$K^*(1410)$ BRANCHING RATIOS**

NODE=M094220

 $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.17	95	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R1
NODE=M094R1 $\Gamma(K\pi)/\Gamma(K^*(892)\pi)$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.16	95	ASTON	84	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M094R2
NODE=M094R2 $\Gamma(K\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.066±0.010±0.008	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M094R3
NODE=M094R3 $\Gamma(K\phi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M094R00
NODE=M094R00¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.7 σ .

NODE=M094R00;LINKAGE=A

 $K^*(1410)$ REFERENCES

NODE=M094

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)
BOITO	09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin	
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>	(BELLE Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)

REFID=61150
REFID=57836
REFID=57273
REFID=52728
REFID=51929
REFID=48822
REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22551
REFID=22545
REFID=22443 **$K_0^*(1430)$**

$$I(J^P) = \frac{1}{2}(0^+)$$

NODE=M019

 $K_0^*(1430)$ T-MATRIX POLE $\sqrt{s}$

NODE=M019PP

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

NODE=M019PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1431 ± 6) − i (110 ± 19) OUR ESTIMATE			
(1431 ± 6) − i (110 ± 19)	¹ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$

NODE=M019PP

→ UNCHECKED ←

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M019PP;LINKAGE=A

 $K_0^*(1430)$ MASS

NODE=M019M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1425 ± 50 OUR ESTIMATE				

NODE=M019M

→ UNCHECKED ←

• • • We do not use the following data for averages, fits, limits, etc. • • •

1493 ± 4 ± 7	¹ AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$	
1449 ± 17 ± 2	² LEES	21A BABR	$\eta_c(1S) \rightarrow \eta' K^+ K^-$	
1438 ± 8 ± 4 5.4k	³ LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$	
1427 ± 4 ± 13	⁴ BUGG	10 RVUE	S-matrix pole	
1466.6 ± 0.7 ± 3.4 141k	⁵ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$	
~ 1412	⁶ LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$	
1461.0 ± 4.0 ± 2.1 54k	⁷ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$	
1406 ± 29	⁸ BUGG	06 RVUE		
1435 ± 6	⁹ ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$	

1455 ± 20 ± 15	ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
1456 ± 8	10 ZHENG	04	RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 1419	11 BUGG	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1440	12 LI	03	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
1459 ± 9	13 AITALA	02	E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1440	14 JAMIN	00	RVUE	$K p \rightarrow K p$
1436 ± 8	15 BARBERIS	98E	OMEG	450 $p p \rightarrow p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ± 25	11 ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1450	16 TORNQVIST	96	RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
1412 ± 6	17 ASTON	88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
~ 1430	BAUBILLIER	84B	HBC	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 1425	18 ESTABROOKS	78	ASPK	13 $K^\pm p \rightarrow K^\pm \pi^\pm (n, \Delta)$
~ 1450.0	MARTIN	78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$ ² Using a $K \pi - K \eta'$ coupled channel Breit-Wigner function. ³ Using both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed width $\Gamma(K_0^*(1430)) = 210$ MeV. ⁴ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K \pi$ and $K \eta'$, and the Adler zero near thresholds. ⁵ From the isobar model with a complex pole for the κ . ⁶ From a non-parametric analysis. ⁷ A Breit-Wigner mass and width. ⁸ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold. ⁹ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$. ¹⁰ Using ASTON 88 and assuming $K_0^*(700)$. ¹¹ T-matrix pole. Reanalysis of ASTON 88 data. ¹² Breit-Wigner fit. Using ASTON 88. ¹³ Assuming a low-mass scalar $K \pi$ resonance, $\kappa(700)$. ¹⁴ T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88. ¹⁵ J^P not determined, could be $K_2^*(1430)$. ¹⁶ T-matrix pole. ¹⁷ Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° . ¹⁸ Mass defined by pole position. From elastic $K \pi$ partial-wave analysis.				

NODE=M019M;LINKAGE=F
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 NODE=M019M;LINKAGE=D

NODE=M019M;LINKAGE=A

$K_0^*(1430)$ WIDTH

NODE=M019W

NODE=M019W
 → UNCHECKED ←

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
270 ± 80 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
215 ± 7 ± 4		1 AAIJ	23AH LHCb	$B^+ \rightarrow K^+ (K_S^0 K \pi)$
210 ± 20 ± 12	5.4k	2 LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta / \pi^0$
270 ± 10 ± 40		3 BUGG	10 RVUE	S-matrix pole
174.2 ± 1.9 ± 3.2	141k	4 BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 500		5 LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$
177.0 ± 8.0 ± 3.4	54k	6 LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
350 ± 40		7 BUGG	06 RVUE	
288 ± 22		8 ZHOU	06 RVUE	$K p \rightarrow K^- \pi^+ n$
270 ± 45 ⁺³⁰ ₋₃₅		ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
217 ± 31		9 ZHENG	04 RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 316		10 BUGG	03 RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 350		11 LI	03 RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
175 ± 17	15k	12 AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 300		13 JAMIN	00 RVUE	$K p \rightarrow K p$
196 ± 45		14 BARBERIS	98E OMEG	450 $p p \rightarrow p_f p_s K^+ K^- \pi^+ \pi^-$
330 ± 50		10 ANISOVICH	97C RVUE	11 $K^- p \rightarrow K^- \pi^+ n$
~ 320		15 TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
294 ± 23		ASTON	88 LASS	11 $K^- p \rightarrow K^- \pi^+ n$
~ 200		BAUBILLIER	84B HBC	8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
200 to 300		16 ESTABROOKS	78 ASPK	13 $K^\pm p \rightarrow K^\pm \pi^\pm (n, \Delta)$

- ¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$.
- ² Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a likelihood scan in the presence of several interfering scalar-meson resonances with fixed mass $M(K_0^*(1430)) = 1435 \text{ MeV}$.
- ³ S-Matrix pole. Supersedes BUGG 06. Combined analysis of ASTON 88, ABLIKIM 06C, AITALA 06, and LINK 09 using an s-dependent width with couplings to $K\pi$ and $K\eta'$, and the Adler zero near thresholds.
- ⁴ From the isobar model with a complex pole for the κ .
- ⁵ From a non-parametric analysis.
- ⁶ A Breit-Wigner mass and width.
- ⁷ S-matrix pole. Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C including the κ with an s-dependent width and an Adler zero near threshold.
- ⁸ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$.
- ⁹ Using ASTON 88 and assuming $K_0^*(700)$.
- ¹⁰ T-matrix pole. Reanalysis of ASTON 88 data.
- ¹¹ Breit-Wigner fit. Using ASTON 88.
- ¹² Assuming a low-mass scalar $K\pi$ resonance, $\kappa(700)$.
- ¹³ T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.
- ¹⁴ J^P not determined, could be $K_2^*(1430)$.
- ¹⁵ T-matrix pole.
- ¹⁶ From elastic $K\pi$ partial-wave analysis.

NODE=M019W;LINKAGE=A
NODE=M019W;LINKAGE=LE

NODE=M019W;LINKAGE=BG

NODE=M019W;LINKAGE=BO
NODE=M019W;LINKAGE=LI
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NODE=M019W;LINKAGE=ZU
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NODE=M019W;LINKAGE=A1
NODE=M019W;LINKAGE=E
NODE=M019W;LINKAGE=A0
NODE=M019W;LINKAGE=JM
NODE=M019W;LINKAGE=JP
NODE=M019W;LINKAGE=TT
NODE=M019W;LINKAGE=C

$K_0^*(1430)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\pi$	$(93 \pm 10) \%$
$\Gamma_2 \quad K\eta$	$(8.6^{+2.7}_{-3.4}) \%$
$\Gamma_3 \quad K\eta'(958)$	seen

NODE=M019215;NODE=M019

DESIG=1

DESIG=2

DESIG=3

$K_0^*(1430)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>CHG</i>	<i>COMMENT</i>		
$0.93\pm0.04\pm0.09$	ASTON	88	LASS	0	11 $K^-p \rightarrow K^- \pi^+ n$	

NODE=M019220

NODE=M019R1
NODE=M019R1

$\Gamma(K\eta)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	
$9.2 \pm 2.5^{+1.0}_{-2.5}$	5.4k	¹ LEES	14E	BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$

NODE=M019R01
NODE=M019R01

- ¹ Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$. From a Dalitz analysis in the presence of several interfering scalar-meson resonances.

NODE=M019R01;LINKAGE=LE

$\Gamma(K\eta'(958))/\Gamma_{\text{total}}$				Γ_3/Γ
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
seen	ABLIKIM	14J	BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M019R00
NODE=M019R00

$\Gamma(K\eta'(958))/\Gamma(K\pi)$	Γ_3/Γ_1			
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.397\pm0.064\pm0.054$	¹ LEES	21A	BABR	$\eta_c(1S) \rightarrow \eta' K^+ K^-$

NODE=M019R02
NODE=M019R02

- ¹ Using $K\pi$ data from LEES 14E.

NODE=M019R02;LINKAGE=A

$K_0^*(1430)$ REFERENCES

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BUGG	10	PR D81 014002	D.V. Bugg	(LOQM)
LINK	09	PL B681 14	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LINK	07	PL B648 156	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
Also		PR D74 059901 (errata.)	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BUGG	06	PL B632 471	D.V. Bugg	(LOQM)
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	

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REFID=51037
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REFID=51458
REFID=50996
REFID=51198

ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ZHENG	04	NP A733 235	H.Q. Zheng <i>et al.</i>	
BUGG	03	PL B572 1	D.V. Bugg	
LI	03	PR D67 034025	L. Li, B. Zou, G. Li	
AITALA	02	PRL 89 121801	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
JAMIN	00	NP B587 331	M. Jamin <i>et al.</i>	
BARBERIS	98E	PL B436 204	D. Barberis <i>et al.</i>	(Omega Expt.)
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev	
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)

REFID=50958
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NODE=M022

$K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

We consider that phase-shift analyses provide more reliable determinations of the mass and width.

NODE=M022

$K_2^*(1430)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \operatorname{Im}(\sqrt{s})$.

NODE=M022PP

NODE=M022PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1424 ± 4) - i (66 ± 2) OUR ESTIMATE			
(1424 ± 4) - i (66 ± 2)	¹ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.			

NODE=M022PP

→ UNCHECKED ←

NODE=M022PP;LINKAGE=A

$K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1427.3 ± 1.5 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
1432.7 ± 0.7 ^{+2.2} _{-2.3}	183k	ABLIKIM	19AQ	BES	± $J/\psi \rightarrow K^+ K^- \pi^0$
1420 ± 4	1587	BAUBILLIER	84B	HBC	- $8.25 K^- p \rightarrow \bar{K}^0 \pi^- p$
1436 ± 5.5	400	^{1,2} CLELAND	82	SPEC	+ $30 K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{1,2} CLELAND	82	SPEC	+ $50 K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{1,2} CLELAND	82	SPEC	- $50 K^+ p \rightarrow K_S^0 \pi^- p$
1423 ± 5	935	TOAFF	81	HBC	- $6.5 K^- p \rightarrow \bar{K}^0 \pi^- p$
1428.0 ± 4.6		³ MARTIN	78	SPEC	+ $10 K^\pm p \rightarrow K_S^0 \pi p$
1423.8 ± 4.6		³ MARTIN	78	SPEC	- $10 K^\pm p \rightarrow K_S^0 \pi p$
1420.0 ± 3.1	1400	AGUILAR...	71B	HBC	- $3.9, 4.6 K^- p \rightarrow K^+ p \rightarrow K^0 \pi^+ p$
1425 ± 8.0	225	^{1,2} BARNHAM	71C	HBC	+ $3.9 K^- N \rightarrow \bar{K}^0 \pi^- N$
1416 ± 10	220	CRENNELL	69D	DBC	- $9 K^+ p \rightarrow K^0 \pi^+ p$
1414 ± 13.0	60	¹ LIND	69	HBC	+ $5.5 K^- p \rightarrow \bar{K} \pi N$
1427 ± 12	63	¹ SCHWEING...	68	HBC	- $4.6-5.0 K^- p \rightarrow \bar{K}^0 \pi^- p$
1423 ± 11.0	39	¹ BASSANO	67	HBC	-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1428 ± 2	4300	⁴ ABLIKIM	22L	BES3	$2.0-3.08 e^+ e^- \rightarrow K^+ K^- \pi^0$
1423.4 ± 2 ± 3	24809 ± 820	⁵ BIRD	89	LASS	- $11 K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

¹ Errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

² Number of events in peak re-evaluated by us.

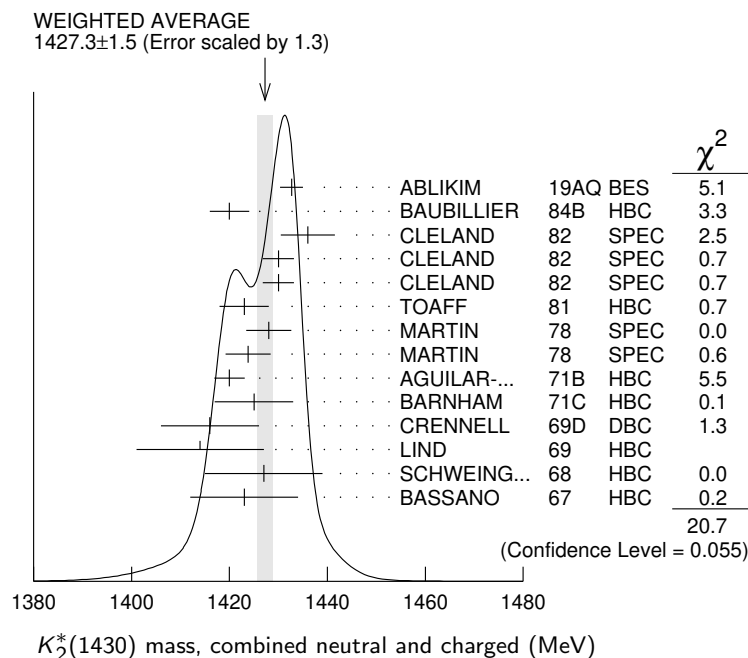
³ Systematic error added by us.

⁴ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.

⁵ From a partial wave amplitude analysis.

NODE=M022M;LINKAGE=D
NODE=M022M;LINKAGE=W
NODE=M022M;LINKAGE=B
NODE=M022M1;LINKAGE=A

NODE=M022M;LINKAGE=F

**NEUTRAL ONLY**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1432.4 ± 1.3 OUR AVERAGE				
1431.2 ± 1.8 ± 0.7	1	ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 4 ± 6	1	ASTON 87	LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1433 ± 6 ± 10	1	ASTON 84B	LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
1471 ± 12	1	BAUBILLIER 82B	HBC	8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
1428 ± 3	1	ASTON 81C	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 2	1	ESTABROOKS 78	ASPK	13 $K^\pm p \rightarrow p K \pi$
1440 ± 10	1	BOWLER 77	DBC	5.5 $K^+ d \rightarrow K \pi p p$
1428.5 ± 3.9	1786 ± 127	2 AUBERT 07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
1420 ± 7	300	HENDRICK 76	DBC	8.25 $K^+ N \rightarrow K^+ \pi N$
1421.6 ± 4.2	800	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
1420.1 ± 4.3		3 LINGLIN 73	HBC	2-13 $K^+ p \rightarrow K^+ \pi^- X$
1419.1 ± 3.7	1800	AGUILAR-... 71B	HBC	3.9, 4.6 $K^- p$
1416 ± 6	600	CORDS 71	DBC	9 $K^+ n \rightarrow K^+ \pi^- p$
1421.1 ± 2.6	2200	DAVIS 69	HBC	12 $K^+ p \rightarrow K^+ \pi^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From phase shift or partial-wave analysis.

² Systematic errors not estimated.

³ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022M4
NODE=M022M4

NODE=M022M;LINKAGE=P
NODE=M022M4;LINKAGE=NS
NODE=M022M;LINKAGE=C

 $K_2^*(1430)$ WIDTH

NODE=M022210

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
100.0 ± 2.2 OUR FIT					Error includes scale factor of 1.1. [100.0 ± 2.1 MeV OUR 2023 FIT]

NODE=M022W1
NODE=M022W1
NEW

100.0 ± 2.2 OUR AVERAGE Error includes scale factor of 1.1.

102.5 ± 1.6 ^{+3.1} _{-2.8}	183k	ABLIKIM	19AQ	BES	±	$J/\psi \rightarrow K^+ K^- \pi^0$
109 ± 22	400	1,2 CLELAND	82	SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
124 ± 12.8	1500	1,2 CLELAND	82	SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
113 ± 12.8	1200	1,2 CLELAND	82	SPEC	-	50 $K^+ p \rightarrow K_S^0 \pi^- p$
85 ± 16	935	TOAFF	81	HBC	-	6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
96.5 ± 3.8		MARTIN	78	SPEC	+	10 $K^\pm p \rightarrow K_S^0 \pi p$
97.7 ± 4.0		MARTIN	78	SPEC	-	10 $K^\pm p \rightarrow K_S^0 \pi p$
94.7 ^{+15.1} _{-12.5}	1400	AGUILAR-...	71B	HBC	-	3.9, 4.6 $K^- p$

OCCUR=2
OCCUR=3

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

107 ± 4	4300	3 ABLIKIM	22L	BES3		2.0-3.08 $e^+ e^- \rightarrow K^+ K^- \pi^0$
98 ± 4 ± 4	25k	4 BIRD	89	LASS	-	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

- ¹ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
² Number of events in peak re-evaluated by us.
³ From a partial wave amplitude analysis at $\sqrt{s} = 2.125$ GeV which includes all the possible intermediate states that match J^{PC} conservation in the subsequent two-body decay. The intermediate states are parameterized with the relativistic Breit-Wigner functions. Statistical error only.
⁴ From a partial wave amplitude analysis.

NODE=M022W;LINKAGE=D
 NODE=M022W;LINKAGE=W
 NODE=M022W1;LINKAGE=A

NODE=M022W;LINKAGE=F

NODE=M022W4
 NODE=M022W4

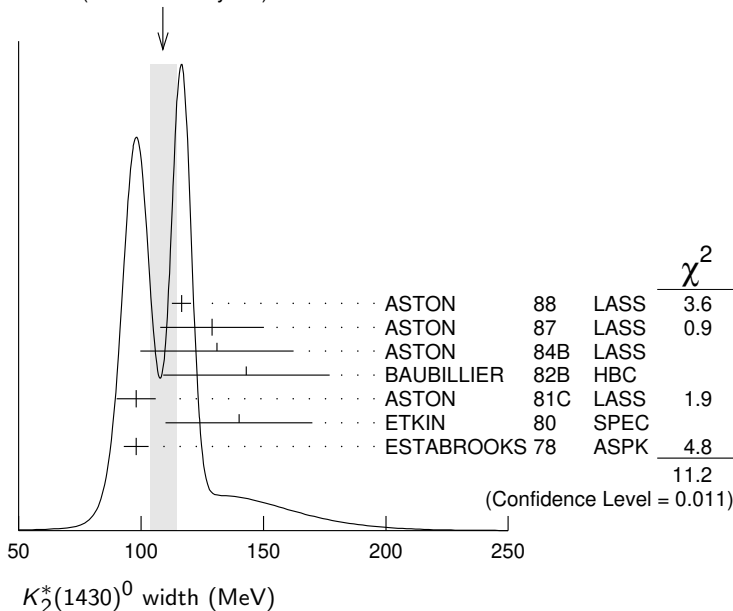
NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
109 ± 5 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
116.5 ± 3.6 ± 1.7		¹ ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
129 ± 15 ± 15		¹ ASTON 87	LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
131 ± 24 ± 20		¹ ASTON 84B	LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
143 ± 34		¹ BAUBILLIER 82B	HBC	8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
98 ± 8		¹ ASTON 81C	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
140 ± 30		¹ ETKIN 80	SPEC	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
98 ± 5		¹ ESTABROOKS 78	ASPK	13 $K^\pm p \rightarrow p K \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
113.7 ± 9.2	1786 ± 127	² AUBERT 07AK	BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
125 ± 29	300	³ HENDRICK 76	DBC	8.25 $K^+ N \rightarrow K^+ \pi N$
116 ± 18	800	MCCUBBIN 75	HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
61 ± 14		⁴ LINGLIN 73	HBC	2-13 $K^+ p \rightarrow K^+ \pi^- X$
116.6 ^{+10.3} _{-15.5}	1800	AGUILAR-...	71B	HBC 3.9,4.6 $K^- p$
144 ± 24.0	600	³ CORDS 71	DBC	9 $K^+ n \rightarrow K^+ \pi^- p$
101 ± 10	2200	DAVIS 69	HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$

- ¹ From phase shift or partial-wave analysis.
² Systematic errors not estimated.
³ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
⁴ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022W;LINKAGE=P
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 NODE=M022W4;LINKAGE=D
 NODE=M022W;LINKAGE=C

WEIGHTED AVERAGE
 109±5 (Error scaled by 1.9)



$K_2^*(1430)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $K \pi$	(49.9 ± 1.2) %	
Γ_2 $K^*(892) \pi$	(24.7 ± 1.5) %	
Γ_3 $K^*(892) \pi \pi$	(13.4 ± 2.2) %	
Γ_4 $K \rho$	(8.7 ± 0.8) %	S=1.2

NODE=M022215;NODE=M022

DESIG=1
 DESIG=2
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Γ_5	$K\omega$	$(2.9 \pm 0.8) \%$		
Γ_6	$K^+\gamma$	$(2.4 \pm 0.5) \times 10^{-3}$	$S=1.1$	
Γ_7	$K\eta$	$(1.5^{+3.4}_{-1.0}) \times 10^{-3}$	$S=1.3$	
Γ_8	$K\omega\pi$	$< 7.2 \times 10^{-4}$	$CL=95\%$	
Γ_9	$K^0\gamma$	$< 9 \times 10^{-4}$	$CL=90\%$	

DESIG=4
DESIG=8
DESIG=5
DESIG=7
DESIG=10;OUR EVAL;→ UNCHECKED ←

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 10 branching ratios uses 32 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 21.1$ for 25 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−9						
x_3	−40	−73					
x_4	−8	36	−52				
x_5	−11	−3	−26	−7			
x_6	−1	−1	−1	−1	0		
x_7	−4	−7	−5	−5	−2	0	
Γ	0	0	0	0	0	−11	0
	x_1	x_2	x_3	x_4	x_5	x_6	x_7

Mode	Rate (MeV)	Scale factor
Γ_1 $K\pi$	49.9 ± 1.6	
Γ_2 $K^*(892)\pi$	24.7 ± 1.6	
Γ_3 $K^*(892)\pi\pi$	13.5 ± 2.3	
Γ_4 $K\rho$	8.7 ± 0.8	1.2
Γ_5 $K\omega$	2.9 ± 0.8	
Γ_6 $K^+\gamma$	0.24 ± 0.05	1.1
Γ_7 $K\eta$	$0.15^{+0.34}_{-0.10}$	1.3

DESIG=1
DESIG=2
DESIG=6
DESIG=3
DESIG=4
DESIG=8
DESIG=5

$K_2^*(1430)$ PARTIAL WIDTHS

NODE=M022220

$\Gamma(K^+\gamma)$

Γ_6

VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT
240 ± 50 OUR FIT				Error includes scale factor of 1.1. [241 ± 50 keV OUR 2023 FIT
Scale factor = 1.1]				

NODE=M022W8
NODE=M022W8
NEW

240 ± 45 CIHANGIR 82 SPEC + 200 $K^+Z \rightarrow ZK^+\pi^0$,
 $ZK_S^0\pi^+$

$\Gamma(K^0\gamma)$

Γ_9

VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT
< 5.4	90	ALAVI-HARATI02B	KTEV		$K + A \rightarrow K^* + A$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 84	90	CARLSMITH	87	SPEC	0 60–200 $K_L^0 A \rightarrow K_S^0 \pi^0 A$

NODE=M022W9
NODE=M022W9

$K_2^*(1430)$ BRANCHING RATIOS

NODE=M022225

$\Gamma(K\pi)/\Gamma_{\text{total}}$

Γ_1/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.499 ± 0.012 OUR FIT				
0.488 ± 0.014 OUR AVERAGE				
$0.485 \pm 0.006 \pm 0.020$	¹ ASTON	88	LASS	0 11 $K^-p \rightarrow K^- \pi^+ n$
0.49 ± 0.02	¹ ESTABROOKS	78	ASPK	$\pm$ 13 $K^\pm p \rightarrow pK\pi$

¹ From phase shift analysis.

NODE=M022R1
NODE=M022R1

NODE=M022R;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$ Γ_2/Γ_1 NODE=M022R4
NODE=M022R4

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.496±0.034 OUR FIT				
0.47 ±0.04 OUR AVERAGE				
0.44 ±0.09	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.62 ±0.19	LAUSCHER	75	HBC	0 10,16 $K^- p \rightarrow K^- \pi^+ n$
0.54 ±0.16	DEHM	74	DBC	0 4.6 $K^+ N$
0.47 ±0.08	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.47 ±0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.45 ±0.13	BADIER	65c	HBC	- 3 $K^- p$

 $\Gamma(K\omega)/\Gamma(K\pi)$ Γ_5/Γ_1 NODE=M022R5
NODE=M022R5

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.059±0.017 OUR FIT				
0.070±0.035 OUR AVERAGE				
0.05 ±0.04	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.13 ±0.07	BASSOMPIE...	69	HBC	0 5 $K^+ p$

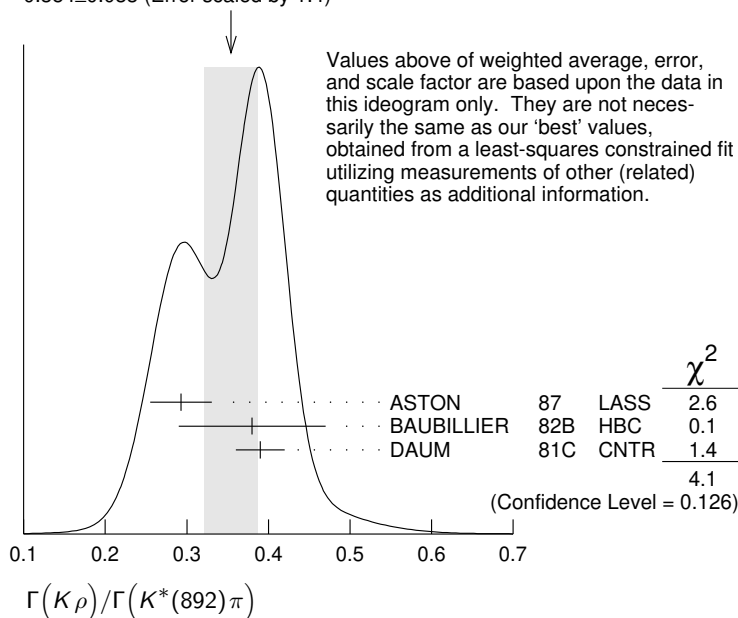
OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ Γ_4/Γ_1 NODE=M022R6
NODE=M022R6

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.174±0.017 OUR FIT	Error includes scale factor of 1.2.			
0.150^{+0.029}_{-0.017} OUR AVERAGE				
0.18 ±0.05	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$
0.02 ^{+0.10} _{-0.02}	DEHM	74	DBC	0 4.6 $K^+ N$
0.16 ±0.05	AGUILAR-...	71B	HBC	3.9,4.6 $K^- p$
0.14 ±0.10	BASSANO	67	HBC	-0 4.6,5.0 $K^- p$
0.14 ±0.07	BADIER	65c	HBC	- 3 $K^- p$

 $\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_4/Γ_2 NODE=M022R7
NODE=M022R7

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.350±0.031 OUR FIT	Error includes scale factor of 1.4.			
0.354±0.033 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
0.293±0.032±0.020	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
0.38 ±0.09	BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
0.39 ±0.03	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

WEIGHTED AVERAGE
0.354±0.033 (Error scaled by 1.4) $\Gamma(K\omega)/\Gamma(K^*(892)\pi)$ Γ_5/Γ_2 NODE=M022R8
NODE=M022R8

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.118±0.034 OUR FIT				
0.10 ±0.04	FIELD	67	HBC	- 3.8 $K^- p$

$\Gamma(K\eta)/\Gamma(K^*(892)\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.006^{+0.014}_{-0.004} OUR FIT Error includes scale factor of 1.2.

0.07 ± 0.04 FIELD 67 HBC - 3.8 $K^- p$

 Γ_7/Γ_2

NODE=M022R9
NODE=M022R9

 $\Gamma(K\eta)/\Gamma(K\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

0.0030^{+0.0070}_{-0.0020} OUR FIT Error includes scale factor of 1.3.

0 ± 0.0056 ¹ ASTON 88B LASS - 11 $K^- p \rightarrow K^- \eta p$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04 95 AGUILAR-... 71B HBC 3.9,4.6 $K^- p$

<0.065 ² BASSOMPIE... 69 HBC 5.0 $K^+ p$

<0.02 BISHOP 69 HBC 3.5 $K^+ p$

¹ ASTON 88B quote < 0.0092 at CL=95%. We convert this to a central value and 1 sigma error in order to be able to use it in our constrained fit.

² Restated by us.

NODE=M022R10
NODE=M022R10

NODE=M022R;LINKAGE=PQ

NODE=M022R;LINKAGE=R

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.134 ± 0.022 OUR FIT

0.12 ± 0.04 ¹ GOLDBERG 76 HBC - 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

¹ Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R11
NODE=M022R11

NODE=M022R;LINKAGE=T

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.27 ± 0.05 OUR FIT

0.21 ± 0.08 ^{1,2} JONGEJANS 78 HBC - 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi \pi$

¹ Restated by us.

² Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R12
NODE=M022R12

NODE=M022R12;LINKAGE=R
NODE=M022R12;LINKAGE=T

 $\Gamma(K\omega\pi)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

<0.72 95 0 JONGEJANS 78 HBC 4 $K^- p \rightarrow p \bar{K}^0 4\pi$

 Γ_8/Γ

NODE=M022R13
NODE=M022R13

 $K_2^*(1430)$ REFERENCES

ABLIKIM	22L	JHEP 2207 045	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALAVI-HARATI	02B	PRL 89 072001	A. Alavi-Harati <i>et al.</i>	(FNAL KTeV Collab.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
CARLSMITH	87	PR D36 3502	D. Carlsmith <i>et al.</i>	(EFI, SACL)
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CIHANGIR	82	PL 117B 123	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
JONGEJANS	78	NP B139 383	B. Jongejans <i>et al.</i>	(ZEEM, CERN, NIJM+)
MARTIN	78	NP B134 392	A.D. Martin <i>et al.</i>	(DURH, GEVA)
BOWLER	77	NP B126 31	M.G. Bowler <i>et al.</i>	(OXF)
GOLDBERG	76	LNC 17 253	J. Goldberg	(HAIF)
HENDRICK	76	NP B112 189	K. Hendrickx <i>et al.</i>	(MONS, SACL, PARIS+)
LAUSCHER	75	NP B86 189	P. Lauscher <i>et al.</i>	(ABCLV Collab.) JP
MCCUBBIN	75	NP B86 13	N.A. McCubbin, L. Lyons	(OXF)
DEHM	74	NP B75 47	G. Dehm <i>et al.</i>	(MPIM, BRUX, MONS, CERN)
LINGLIN	73	NP B55 408	D. Linglin	(CERN)
AGUILAR-...	71B	PR D4 2583	M. Aguilar-Benitez, R.L. Eisner, J.B. Kinson	(BNL)
BARNHAM	71C	NP B28 171	K.W.J. Barnham <i>et al.</i>	(BIRM, GLAS)
CORDS	71	PR D4 1974	D. Cords <i>et al.</i>	(PURD, UCD, IUPU)
BASSOMPIE...	69	NP B13 189	G. Bassompierre <i>et al.</i>	(CERN, BRUX) JP
BISHOP	69	NP B9 403	J.M. Bishop <i>et al.</i>	(WISC)
CRENNELL	69D	PRL 22 487	D.J. Crennell <i>et al.</i>	(BNL)
DAVIS	69	PRL 23 1071	P.J. Davis <i>et al.</i>	(LRL)
LIND	69	NP B14 1	V.G. Lind <i>et al.</i>	(LRL) JP
SCHWEING...	68	PR 166 1317	F. Schweingruber <i>et al.</i>	(ANL, NWES)
Also		Thesis	F.L. Schweingruber	(NWES, NWES)
BASSANO	67	PRL 19 968	D. Bassano <i>et al.</i>	(BNL, SYRA)
FIELD	67	PL 24B 638	J.H. Field <i>et al.</i>	(UCSD)
BADIER	65C	PL 19 612	J. Badier <i>et al.</i>	(EPOL, SACL, AMST)

NODE=M022

REFID=61649
REFID=59909
REFID=57836
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REFID=48822
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REFID=22709
REFID=22695
REFID=22701
REFID=22690

$K(1460)$

$$I(J^P) = \frac{1}{2}(0^-)$$

Observed in $K\pi\pi$ partial-wave analysis. **$K(1460)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$1482.40 \pm 3.58 \pm 15.22$	894k	AAIJ	18AI	LHCB	$D^0 \rightarrow K^\mp 2\pi^\pm \pi^\mp$
~ 1460	63	DAUM	81C	CNTR	$K^- p \rightarrow K^- 2\pi p$
~ 1400	13	¹ BRANDENB...	76B	ASPK	$K^\pm p \rightarrow K^\pm 2\pi p$

¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.

 $K(1460)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$335.60 \pm 6.20 \pm 8.65$	894k	AAIJ	18AI	LHCB	$D^0 \rightarrow K^\mp 2\pi^\pm \pi^\mp$
~ 260	63	DAUM	81C	CNTR	$K^- p \rightarrow K^- 2\pi p$
~ 250	15	¹ BRANDENB...	76B	ASPK	$K^\pm p \rightarrow K^\pm 2\pi p$

¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.

 $K(1460)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K\rho$	seen
Γ_3 $K_0^*(1430)\pi$	seen
Γ_4 $K\phi$	seen

 $K(1460)$ PARTIAL WIDTHS

$\Gamma(K^*(892)\pi)$					Γ_1
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 109	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	
$\Gamma(K\rho)$					Γ_2
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 34	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	
$\Gamma(K_0^*(1430)\pi)$					Γ_3
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
~ 117	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	
$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi \phi K^+$	

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 12 σ .

 $K(1460)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
AAIJ	18AI	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59187
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=22548
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22767

NODE=M021

NODE=M021

NODE=M021M

NODE=M021M

NODE=M021M;LINKAGE=A

NODE=M021W

NODE=M021W

NODE=M021W;LINKAGE=A

NODE=M021215;NODE=M021

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

NODE=M021220

NODE=M021W1
NODE=M021W1NODE=M021W2
NODE=M021W2NODE=M021W3
NODE=M021W3NODE=M021R00
NODE=M021R00

NODE=M021R00;LINKAGE=A

NODE=M021

$K_2(1580)$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of the $K^- \pi^+ \pi^-$ system. Needs confirmation.

NODE=M039

NODE=M039

$K_2(1580)$ MASS

NODE=M039M

NODE=M039M

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 1580	OTTER	79	— 10,14,16 $K^- p$

$K_2(1580)$ WIDTH

NODE=M039W

NODE=M039W

VALUE (MeV)	DOCUMENT ID	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
~ 110	OTTER	79	— 10,14,16 $K^- p$

$K_2(1580)$ DECAY MODES

NODE=M039215;NODE=M039

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	seen
Γ_2 $K_2^*(1430)\pi$	possibly seen

DESIG=1

DESIG=2

$K_2(1580)$ BRANCHING RATIOS

NODE=M039220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	OTTER	79	HBC	—	10,14,16 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
possibly seen	GULER	11	BELL	$B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$	

NODE=M039R1
NODE=M039R1

$\Gamma(K_2^*(1430)\pi)/\Gamma_{\text{total}}$					Γ_2/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
possibly seen	OTTER	79	HBC	— 10,14,16 $K^- p$	

NODE=M039R2
NODE=M039R2

$K_2(1580)$ REFERENCES

NODE=M039

GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
OTTER	79	NP B147 1	G. Otter <i>et al.</i>	(AACH3, BERL, CERN, LOIC+) JP

REFID=53668
REFID=22772

K(1630)

I(J^P) = 1/2(?)^?

OMITTED FROM SUMMARY TABLE

Seen as a narrow peak, compatible with the experimental resolution, in the invariant mass of the K_S^0 pi^+ pi^- system produced in pi^- p interactions at high momentum transfers.

NODE=M160

NODE=M160

K(1630) MASS

NODE=M160M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1629±7	~ 75	KARNAUKHOV98	BC	16.0 pi^- p -> (K_S^0 pi^+ pi^-) X^+ pi^- X^0

NODE=M160M

K(1630) WIDTH

NODE=M160W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16+19-16	~ 75	1 KARNAUKHOV98	BC	16.0 pi^- p -> (K_S^0 pi^+ pi^-) X^+ pi^- X^0

NODE=M160W

1 Compatible with an experimental resolution of 14 ± 1 MeV.

NODE=M160W;LINKAGE=A

K(1630) DECAY MODES

NODE=M160215;NODE=M160

Mode
Gamma_1 K_S^0 pi^+ pi^-

DESIG=1

K(1630) REFERENCES

NODE=M160

KARNAUKHOV 98 PAN 61 203 V.M. Karnaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

REFID=46371

NODE=M099

K_1(1650)

I(J^P) = 1/2(1^+)

This entry contains various peaks in strange meson systems (K^+ phi, K pi pi) reported in partial-wave analysis in the 1600-1900 mass region.

NODE=M099

K_1(1650) MASS

NODE=M099M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1650±50		FRAME	86	OMEG +	13 K^+ p -> phi K^+ p
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1861±10+16-46	24k	1 AAIJ	21E	LHCB	B^+ -> J/psi phi K^+
1911±37+124-48	24k	1 AAIJ	21E	LHCB	B^+ -> J/psi phi K^+
1793±59+153-101	4289	2,3 AAIJ	17C	LHCB	B^+ -> J/psi phi K^+
~ 1840		ARMSTRONG	83	OMEG -	18.5 K^- p -> 3K p
~ 1800		DAUM	81C	CNTR -	63 K^- p -> K^- 2pi p

NODE=M099M

OCCUR=2

1 One of two K_1 states reported by AAIJ 21E. From an amplitude analysis of the decay B^+ -> J/psi phi K^+ with a significance of 4.5 sigma.
2 From an amplitude analysis of the decay B^+ -> J/psi phi K^+ with a significance of 7.6 sigma.
3 Superseded by AAIJ 21E.

NODE=M099M;LINKAGE=C

NODE=M099M;LINKAGE=A
NODE=M099M;LINKAGE=B

K_1(1650) WIDTH

NODE=M099W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
150± 50		FRAME	86	OMEG +	13 K^+ p -> phi K^+ p

NODE=M099W

• • • We do not use the following data for averages, fits, limits, etc. • • •

$149 \pm 41^{+231}_{-23}$	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$276 \pm 50^{+319}_{-159}$	24k	¹ AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$365 \pm 157^{+138}_{-215}$	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
~ 250	DAUM	81C	CNTR	—	$63 K^- p \rightarrow K^- 2\pi p$

¹ One of two K_1 states reported by AAIJ 21E. From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 4.5σ .

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

³ Superseded by AAIJ 21E.

OCCUR=2

NODE=M099W;LINKAGE=C

NODE=M099W;LINKAGE=A

NODE=M099W;LINKAGE=B

$K_1(1650)$ DECAY MODES

NODE=M099215;NODE=M099

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K \phi$

DESIG=1

DESIG=2

$K_1(1650)$ REFERENCES

NODE=M099

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

REFID=61150
REFID=57657
REFID=57636
REFID=20569
REFID=22801
REFID=22548

NODE=M095

$K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

$K^*(1680)$ MASS

NODE=M095M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1718±18 OUR AVERAGE					
$1722 \pm 20^{+33}_{-109}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$1677 \pm 10 \pm 32$		ASTON	88	LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
$1735 \pm 10 \pm 20$		ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1678 ± 64		BIRD	89	LASS	— $11 K^- p \rightarrow \bar{K}^0 \pi^- p$
1800 ± 70		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
~ 1650		ESTABROOKS	78	ASPK	0 $13 K^\pm p \rightarrow K^\pm \pi^\pm n$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

NODE=M095M

NODE=M095M;LINKAGE=A

$K^*(1680)$ WIDTH

NODE=M095W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
320±110 OUR AVERAGE Error includes scale factor of 4.2. [322 ± 110 MeV OUR 2023 AVERAGE Scale factor = 4.2]					
$354 \pm 75^{+140}_{-181}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$205 \pm 16 \pm 34$		ASTON	88	LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
$423 \pm 18 \pm 30$		ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
454 ± 270		BIRD	89	LASS	— $11 K^- p \rightarrow \bar{K}^0 \pi^- p$
170 ± 30		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
$250 \text{ to } 300$		ESTABROOKS	78	ASPK	0 $13 K^\pm p \rightarrow K^\pm \pi^\pm n$

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

NODE=M095W

NEW

NODE=M095W;LINKAGE=A

$K^*(1680)$ DECAY MODES

NODE=M095215;NODE=M095

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	$(38.7 \pm 2.5) \%$
Γ_2 $K\rho$	$(31.4^{+5.0}_{-2.1}) \%$
Γ_3 $K^*(892)\pi$	$(29.9^{+2.2}_{-5.0}) \%$
Γ_4 $K\phi$	seen
Γ_5 $K\eta$	$(1.4^{+1.0}_{-0.8}) \%$

DESIG=1

DESIG=3

DESIG=2

DESIG=4

DESIG=6

CONSTRAINED FIT INFORMATION

An overall fit to 4 branching ratios uses 4 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 2.9$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-36	
x_3	-39	-72
	x_1	x_2

 $K^*(1680)$ BRANCHING RATIOS

NODE=M095220

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.387 ± 0.026 OUR FIT						
$0.388 \pm 0.014 \pm 0.022$	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M095R4
NODE=M095R4

$\Gamma(K\pi)/\Gamma(K^*(892)\pi)$						Γ_1/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.30^{+0.23}_{-0.14}$ OUR FIT						
2.8 ± 1.1	ASTON	84	LASS	0	11 $K^- p \rightarrow \bar{K}^0 2\pi n$	

NODE=M095R2
NODE=M095R2

$\Gamma(K\rho)/\Gamma(K\pi)$						Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$0.81^{+0.14}_{-0.09}$ OUR FIT						
1.2 ± 0.4	ASTON	84	LASS	0	11 $K^- p \rightarrow \bar{K}^0 2\pi n$	

NODE=M095R3
NODE=M095R3

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$						Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
$1.05^{+0.27}_{-0.11}$ OUR FIT						
$0.97 \pm 0.09^{+0.30}_{-0.10}$	ASTON	87	LASS	0	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	

NODE=M095R1
NODE=M095R1

$\Gamma(K\phi)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
seen	24k	³ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi \phi K^+$		
• • • We do not use the following data for averages, fits, limits, etc. • • •						
seen	4289	^{4,5} AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$		

NODE=M095R00
NODE=M095R00

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 4.7σ .

⁴ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.5σ .

⁵ Superseded by AAIJ 21E.

NODE=M095R00;LINKAGE=B
NODE=M095R00;LINKAGE=A
NODE=M095R00;LINKAGE=C

$\Gamma(K\eta)/\Gamma(K\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.037$\pm$0.007$^{+0.024}_{-0.018}$	116k	⁶ CHEN	20A BELL	$D^0 \rightarrow K^- \pi^+ \eta$

⁶ CHEN 20A quotes the ratio $\Gamma(K^*(1680)^- \rightarrow K^- \eta)/\Gamma(K^*(1680)^- \rightarrow K^- \pi^0)$ = 0.11 $\pm$ 0.02 $^{+0.06}_{-0.04}$ $\pm$ 0.04(BPDG) where the last uncertainty comes from $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.20)\%$. We divide it by 3 taking into account that $\Gamma(K^*(1680)^- \rightarrow K^- \pi^0)/\Gamma(K^*(1680)^- \rightarrow (K\pi)^-) = 1/3$.

 $\Gamma(K\eta)/\Gamma_{\text{total}}$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.44$\pm$0.21$^{+0.96}_{-0.73}$	116k	⁷ CHEN	20A BELL	$D^0 \rightarrow K^- \pi^+ \eta$

⁷ From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 16 σ . Not independent of the CHEN 20A measurement of $\Gamma(K^*(1680) \rightarrow K\eta)/\Gamma(K^*(1680) \rightarrow K\pi)$.

 $K^*(1680)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(Belle Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	84	PL 149B 258	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP

 $K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04.

 $K_2(1770)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1773$\pm$ 8 OUR AVERAGE					
1777 $\pm$ 35 $^{+122}_{-77}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1773 $\pm$ 8		² ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$
1743 $\pm$ 15		TIKHOMIROV 03	SPEC		$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1810 $\pm$ 20		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
$\sim$ 1730		ARMSTRONG	83	OMEG -	$18.5 K^- p \rightarrow 3K p$
$\sim$ 1780		³ DAUM	81c	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$
1710 $\pm$ 15	60	CHUNG	74	HBC -	$7.3 K^- p \rightarrow K^- \omega p$
1767 $\pm$ 6		BLIEDEN	72	MMS -	$11-16 K^- p$
1730 $\pm$ 20	306	⁴ FIRESTONE	72B	DBC +	$12 K^+ d$
1765 $\pm$ 40		⁵ COLLEY	71	HBC +	$10 K^+ p \rightarrow K 2\pi N$
1740		DENEGRI	71	DBC -	$12.6 K^- d \rightarrow \bar{K} 2\pi d$
1745 $\pm$ 20		AGUILAR-...	70c	HBC -	$4.6 K^- p$
1780 $\pm$ 15		BARTSCH	70c	HBC -	$10.1 K^- p$
1760 $\pm$ 15		LUDLAM	70	HBC -	$12.6 K^- p$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .

² From a partial wave analysis of the $K^- \omega$ system.

³ From a partial wave analysis of the $K^- 2\pi$ system.

⁴ Produced in conjunction with excited deuteron.

⁵ Systematic errors added correspond to spread of different fits.

 $K_2(1770)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
186$\pm$ 14 OUR AVERAGE					
217 $\pm$ 116 $^{+221}_{-154}$	4289	⁶ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
186 $\pm$ 14		⁷ ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$

NODE=M095R02
NODE=M095R02

NODE=M095R02;LINKAGE=A

NODE=M095R01
NODE=M095R01

NODE=M095R01;LINKAGE=A

NODE=M095

REFID=61150
REFID=60333
REFID=57657
REFID=57636
REFID=41002
REFID=40262
REFID=40234
REFID=22689
REFID=22545
REFID=22443

NODE=M023

NODE=M023

NODE=M023M

NODE=M023M

NODE=M023M;LINKAGE=C
NODE=M023M;LINKAGE=A
NODE=M023M;LINKAGE=B
NODE=M023M;LINKAGE=P
NODE=M023M;LINKAGE=X

NODE=M023W

NODE=M023W

• • • We do not use the following data for averages, fits, limits, etc. • • •

147 ± 70		TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
140 ± 40		FRAME 86	OMEG +	13 $K^+ p \rightarrow \phi K^+ p$
~ 220		ARMSTRONG 83	OMEG -	18.5 $K^- p \rightarrow 3K p$
~ 210		⁸ DAUM 81C	CNTR -	63 $K^- p \rightarrow K^- 2\pi p$
110 ± 50	60	CHUNG 74	HBC -	7.3 $K^- p \rightarrow K^- \omega p$
100 ± 26		BLIEDEN 72	MMS -	11-16 $K^- p$
210 ± 30	306	⁹ FIRESTONE 72B	DBC +	12 $K^+ d$
90 ± 70		¹⁰ COLLEY 71	HBC +	10 $K^+ p \rightarrow K 2\pi N$
130		DENEGRI 71	DBC -	12.6 $K^- d \rightarrow \bar{K} 2\pi d$
100 ± 50		AGUILAR-... 70C	HBC -	4.6 $K^- p$
138 ± 40		BARTSCH 70C	HBC -	10.1 $K^- p$
50 $^{+40}_{-20}$		LUDLAM 70	HBC -	12.6 $K^- p$

⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .

⁷ From a partial wave analysis of the $K^- \omega$ system.

⁸ From a partial wave analysis of the $K^- 2\pi$ system.

⁹ Produced in conjunction with excited deuteron.

¹⁰ Systematic errors added correspond to spread of different fits.

NODE=M023W;LINKAGE=A

NODE=M023W;LINKAGE=B

NODE=M023W;LINKAGE=C

NODE=M023W;LINKAGE=P

NODE=M023W;LINKAGE=X

$K_2(1770)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \pi \pi$	
Γ_2 $K_2^*(1430) \pi$	seen
Γ_3 $K^*(892) \pi$	seen
Γ_4 $K f_2(1270)$	seen
Γ_5 $K f_0(980)$	possibly seen
Γ_6 $K \phi$	seen
Γ_7 $K \omega$	seen

NODE=M023215;NODE=M023

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

DESIG=11;OUR EVAL;→ UNCHECKED ←

DESIG=10

DESIG=8

$K_2(1770)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ Γ_2/Γ_1
 $(K_2^*(1430) \rightarrow K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.03	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$
~ 1.0	¹¹ FIRESTONE 72B	DBC +	12 $K^+ d$
<1.0	COLLEY 71	HBC	10 $K^+ p$
0.2 ± 0.2	AGUILAR-... 70C	HBC -	4.6 $K^- p$
<1.0	BARTSCH 70C	HBC -	10.1 $K^- p$
1.0	BARBARO-... 69	HBC +	12.0 $K^+ p$

¹¹ Produced in conjunction with excited deuteron.

NODE=M023220

NODE=M023R1

NODE=M023R1

NODE=M023R1

NODE=M023R1;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.23	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$ Γ_4/Γ_1
 $(f_2(1270) \rightarrow \pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 0.74	DAUM 81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$

$\Gamma(K f_0(980))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	TIKHOMIROV 03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

NODE=M023R3

NODE=M023R3

NODE=M023R4

NODE=M023R4

NODE=M023R4

NODE=M023R6

NODE=M023R6

$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
seen	24k	¹² AAIJ	21E	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
seen		ARMSTRONG	83	OMEG	$18.5 K^- p \rightarrow K^- \phi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	^{13,14} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
¹² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.9 σ .					
¹³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0 σ .					
¹⁴ Superseded by AAIJ 21E.					

NODE=M023R5
NODE=M023R5

NODE=M023R5;LINKAGE=C
NODE=M023R5;LINKAGE=A
NODE=M023R5;LINKAGE=B

$\Gamma(K\omega)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	OTTER	81	HBC	$\pm$	8.25,10,16 $K^\pm p$
seen	CHUNG	74	HBC	$-$	7.3 $K^- p \rightarrow K^- \omega p$

NODE=M023R2
NODE=M023R2

$K_2(1770)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
Translated from YAF 66 860.				
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
FRAME	86	NP B276 667	D. Frame <i>et al.</i>	(GLAS)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
OTTER	81	NP B181 1	G. Otter	(AACH3, BERL, LOIC, VIEN, BIRM+)
CHUNG	74	PL 51B 413	S.U. Chung <i>et al.</i>	(BNL)
BLIEDEN	72	PL 39B 668	H.R. Blieden <i>et al.</i>	(STON, NEAS)
FIRESTONE	72B	PR D5 505	A. Firestone <i>et al.</i>	(LBL)
COLLEY	71	NP B26 71	D.C. Colley <i>et al.</i>	(BIRM, GLAS)
DENEGRI	71	NP B28 13	D. Denegri <i>et al.</i>	(JHU) JP
AGUILAR...	70C	PRL 25 54	M. Aguilar-Benitez <i>et al.</i>	(BNL)
BARTSCH	70C	PL 33B 186	J. Bartsch <i>et al.</i>	(AACH, BERL, CERN+)
LUDLAM	70	PR D2 1234	T. Ludlam, J. Sandweiss, A.J. Slaughter	(YALE)
BARBARO...	69	PRL 22 1207	A. Barbaro-Galtieri <i>et al.</i>	(LRL)

NODE=M023

REFID=61150
REFID=57657
REFID=57636
REFID=49653
REFID=49423

REFID=43597
REFID=20569
REFID=22801
REFID=22548
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REFID=22735
REFID=22788
REFID=22506
REFID=22785
REFID=22497
REFID=22782
REFID=22783
REFID=22784
REFID=22483

NODE=M060

$$K_3^*(1780) \quad I(J^P) = \frac{1}{2}(3^-)$$

$K_3^*(1780)$ T-MATRIX POLE $\sqrt{s}$

Note that $\Gamma = -2 \text{Im}(\sqrt{s})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1754 $\pm$ 13)– i (119 $\pm$ 14) OUR EVALUATION			
(1754 $\pm$ 13)– i (119 $\pm$ 14)	¹ PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.			

NODE=M060PP

NODE=M060PP

NODE=M060PP
→ UNCHECKED ←

NODE=M060PP;LINKAGE=A

$K_3^*(1780)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1779 $\pm$ 8 OUR AVERAGE Error includes scale factor of 1.2.					
1813 $\pm$ 15 $^{+65}_{-16}$	18k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1781 $\pm$ 8 $\pm$ 4		² ASTON	88	LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
1740 $\pm$ 14 $\pm$ 15		² ASTON	87	LASS	0 $11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1779 $\pm$ 11		³ BALDI	76	SPEC	+ $10 K^+ p \rightarrow K^0 \pi^+ p$
1776 $\pm$ 26		⁴ BRANDENB...	76D	ASPK	0 $13 K^\pm p \rightarrow K^\pm \pi^\mp N$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1720 $\pm$ 10 $\pm$ 15	6111	⁵ BIRD	89	LASS	$-$ $11 K^- p \rightarrow \bar{K}^0 \pi^- p$
1749 $\pm$ 10		ASTON	88B	LASS	$-$ $11 K^- p \rightarrow K^- \eta p$
1780 $\pm$ 9	300	BAUBILLIER	84B	HBC	$-$ $8.25 K^- p \rightarrow \bar{K}^0 \pi^- p$
1790 $\pm$ 15		BAUBILLIER	82B	HBC	0 $8.25 K^- p \rightarrow K_S^0 2\pi N$
1784 $\pm$ 9	2060	CLELAND	82	SPEC	$\pm$ $50 K^+ p \rightarrow K_S^0 \pi^\pm p$
1786 $\pm$ 15		⁶ ASTON	81D	LASS	0 $11 K^- p \rightarrow K^- \pi^+ n$
1762 $\pm$ 9	190	TOAFF	81	HBC	$-$ $6.5 K^- p \rightarrow \bar{K}^0 \pi^- p$
1850 $\pm$ 50		ETKIN	80	MPS	0 $6 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
1812 $\pm$ 28		BEUSCH	78	OMEG	$10 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786 $\pm$ 8		CHUNG	78	MPS	0 $6 K^- p \rightarrow K^- \pi^+ n$

NODE=M060M

NODE=M060M

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (2.0 \pm 0.4^{+1.9}_{-0.4}) \times 10^{-6}$.

² From energy-independent partial-wave analysis.

³ From a fit to Y_6^2 moment. $J^P = 3^-$ found.

⁴ Confirmed by phase shift analysis of ESTABROOKS 78, yields $J^P = 3^-$.

⁵ From a partial wave amplitude analysis.

⁶ From a fit to the Y_6^0 moment.

NODE=M060M;LINKAGE=D

NODE=M060M;LINKAGE=K

NODE=M060M;LINKAGE=M

NODE=M060M;LINKAGE=A

NODE=M060M;LINKAGE=F

NODE=M060M;LINKAGE=J

$K_3^*(1780)$ WIDTH

NODE=M060W

NODE=M060W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
161±17 OUR AVERAGE Error includes scale factor of 1.1.					
$191^{+43}_{-37} \pm 3$	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
$203 \pm 30 \pm 8$		² ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
$171 \pm 42 \pm 20$		² ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
135 ± 22		³ BALDI	76	SPEC	+ 10 $K^+ p \rightarrow K^0 \pi^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$187 \pm 31 \pm 20$	6111	⁴ BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
193^{+51}_{-37}		ASTON	88B	LASS	- 11 $K^- p \rightarrow K^- \eta p$
99 ± 30	300	BAUBILLIER	84B	HBC	- 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
~ 130		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
191 ± 24	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
225 ± 60		⁵ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
~ 80	190	TOAFF	81	HBC	- 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
240 ± 50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
181 ± 44		⁶ BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
96 ± 31		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$
270 ± 70		⁷ BRANDENB...	76D	ASPK	0 13 $K^\pm p \rightarrow K^\pm \pi^\mp N$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (2.0 \pm 0.4^{+1.9}_{-0.4}) \times 10^{-6}$.

² From energy-independent partial-wave analysis.

³ From a fit to Y_6^2 moment. $J^P = 3^-$ found.

⁴ From a partial wave amplitude analysis.

⁵ From a fit to Y_6^0 moment.

⁶ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

⁷ ESTABROOKS 78 find that BRANDENBURG 76D data are consistent with 175 MeV width. Not averaged.

NODE=M060W;LINKAGE=A

NODE=M060W;LINKAGE=K

NODE=M060W;LINKAGE=M

NODE=M060W;LINKAGE=F

NODE=M060W;LINKAGE=J

NODE=M060W;LINKAGE=D

NODE=M060W;LINKAGE=E

$K_3^*(1780)$ DECAY MODES

NODE=M060215;NODE=M060

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $K\rho$	(31 ± 9) %	
Γ_2 $K^*(892)\pi$	(20 ± 5) %	
Γ_3 $K\pi$	(18.8 ± 1.0) %	
Γ_4 $K\eta$	(30 ± 13) %	
Γ_5 $K_2^*(1430)\pi$	< 16 %	95%

DESIG=3

DESIG=2

DESIG=1

DESIG=6

DESIG=4

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 4 measurements and one constraint to determine 4 parameters. The overall fit has a $\chi^2 = 0.0$ for 1 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	85		
x_3	18	21	
x_4	-98	-94	-27
	x_1	x_2	x_3

$K_3^*(1780)$ BRANCHING RATIOS

NODE=M060220

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$

 Γ_1/Γ_2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.52±0.23 OUR FIT				
1.52±0.21±0.10	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R5
NODE=M060R5

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$

 Γ_2/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.09±0.26 OUR FIT				
1.09±0.26	ASTON	84B	LASS	0 11 $K^- p \rightarrow \bar{K}^0 2\pi n$

NODE=M060R7
NODE=M060R7

$\Gamma(K\pi)/\Gamma_{\text{total}}$

 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.188±0.010 OUR FIT				
0.188±0.010 OUR AVERAGE				
0.187±0.008±0.008	ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
0.19 ±0.02	ESTABROOKS	78	ASPK	0 13 $K^\pm p \rightarrow K\pi N$

NODE=M060R4
NODE=M060R4

$\Gamma(K\eta)/\Gamma(K\pi)$

 Γ_4/Γ_3

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
1.6 ±0.7 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.41±0.050	¹ BIRD	89	LASS	— 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
0.50±0.18	ASTON	88B	LASS	— 11 $K^- p \rightarrow K^- \eta p$

NODE=M060R8
NODE=M060R8

¹ This result supersedes ASTON 88B.

NODE=M060R8;LINKAGE=H

$\Gamma(K_2^*(1430)\pi)/\Gamma(K^*(892)\pi)$

 Γ_5/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.78	95	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M060R6
NODE=M060R6

$K_3^*(1780)$ REFERENCES

NODE=M060

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
BIRD	89	SLAC-332	P.F. Bird	(SLAC)	REFID=41002
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
ASTON	88B	PL B201 169	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS) JP	REFID=40281
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40234
ASTON	84B	NP B247 261	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA)	REFID=22763
BAUBILLIER	84B	ZPHY C26 37	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22459
BAUBILLIER	82B	NP B202 21	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=22551
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=22455
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP	REFID=22820
TOAFF	81	PR D23 1500	S. Toaff <i>et al.</i>	(ANL, KANS)	REFID=22454
ETKIN	80	PR D22 42	A. Etkin <i>et al.</i>	(BNL, CUNY) JP	REFID=22545
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP	REFID=22537
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP	REFID=22814
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP	REFID=22443
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22444
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP	REFID=22807
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP	REFID=22808

$K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$.

NODE=M146

NODE=M146

NODE=M146M

NODE=M146M

NODE=M146M;LINKAGE=B

NODE=M146M;LINKAGE=A

NODE=M146M;LINKAGE=C

NODE=M146W

NODE=M146W

NODE=M146W;LINKAGE=A

NODE=M146W;LINKAGE=B

NODE=M146W;LINKAGE=C

NODE=M146215;NODE=M146

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7

NODE=M146220

NODE=M146R1

NODE=M146R1

NODE=M146R2

NODE=M146R2

NODE=M146R3

NODE=M146R3

 $K_2(1820)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1819±12 OUR AVERAGE				
$1853 \pm 27^{+18}_{-35}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
1816 ± 13		² ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 1840		³ DAUM	81C CNTR	$63K^- p \rightarrow K^- 2\pi p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
² From a partial wave analysis of the $K^- \omega$ system.				
³ From a partial wave analysis of the $K^- 2\pi$ system.				

 $K_2(1820)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
264±34 OUR AVERAGE				
$167 \pm 58^{+82}_{-72}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
276 ± 35		² ASTON	93 LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 230		³ DAUM	81C CNTR	$63K^- p \rightarrow K^- 2\pi p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .				
² From a partial wave analysis of the $K^- \omega$ system.				
³ From a partial wave analysis of the $K^- 2\pi$ system.				

 $K_2(1820)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi\pi$	seen
Γ_2 $K_2^*(1430)\pi$	seen
Γ_3 $K^*(892)\pi$	seen
Γ_4 $Kf_2(1270)$	seen
Γ_5 $K\omega$	seen
Γ_6 $K\phi$	seen

 $K_2(1820)$ BRANCHING RATIOS

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.77	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.05	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$	
$\Gamma(Kf_2(1270))/\Gamma(K\pi\pi)$				Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.18	DAUM	81C CNTR	$63K^- p \rightarrow \bar{K} 2\pi p$	

$\Gamma(K\phi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	^{2,3} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.8 σ .					
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .					
³ Superseded by AAIJ 21E.					

NODE=M146R00
NODE=M146R00

NODE=M146R00;LINKAGE=B
NODE=M146R00;LINKAGE=A
NODE=M146R00;LINKAGE=C

K₂(1820) REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)
ASTON	93	PL B308 186	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)

NODE=M146

REFID=61150
REFID=57657
REFID=57636
REFID=49653
REFID=43597
REFID=22548

K(1830)

$I(J^P) = \frac{1}{2}(0^-)$

OMITTED FROM SUMMARY TABLE
Seen in partial-wave analysis of $K\phi$ system. Needs confirmation.

NODE=M088

NODE=M088

K(1830) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1874 \pm 43^{+59}_{-115}$	4289	^{1,2} AAIJ	17C LHCb		$B^+ \rightarrow J/\psi \phi K^+$
~ 1830		ARMSTRONG 83	OMEG -		$18.5 K^- p \rightarrow 3K p$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.5 σ .					
² A subsequent amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ by AAIJ 21E did not confirm this measurement.					

NODE=M088M

NODE=M088M

NODE=M088M;LINKAGE=A
NODE=M088M;LINKAGE=B

K(1830) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$168 \pm 90^{+280}_{-104}$	4289	^{3,4} AAIJ	17C LHCb		$B^+ \rightarrow J/\psi \phi K^+$
~ 250		ARMSTRONG 83	OMEG -		$18.5 K^- p \rightarrow 3K p$
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.5 σ .					
⁴ A subsequent amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ by AAIJ 21E did not confirm this measurement.					

NODE=M088W

NODE=M088W

NODE=M088W;LINKAGE=A
NODE=M088W;LINKAGE=B

K(1830) DECAY MODES

Mode
$\Gamma_1 \quad K\phi$

NODE=M088215;NODE=M088

DESIG=1

K(1830) REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
ARMSTRONG	83	NP B221 1	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+) JP

NODE=M088

REFID=61150
REFID=57657
REFID=57636
REFID=22801

NODE=M134

$K_0^*(1950)$

$I(J^P) = \frac{1}{2}(0^+)$

Seen in partial-wave analysis of the $K^- \pi^+$ system. Needs confirmation.

NODE=M134

$K_0^*(1950)$ MASS

NODE=M134M

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1957±14 OUR AVERAGE				
[1944 ± 18 MeV OUR 2023 AVERAGE]				
1980±14±19	¹ AAIJ	23AH	LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
1942±22±21	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' K^+ K^-$
1945±10±20	² ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1917±12	³ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
1820±40	⁴ ANISOVICH	97C	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$				
² We take the central value of the two solutions and the larger error given.				
³ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.				
⁴ T-matrix pole. Reanalysis of ASTON 88 data.				

NODE=M134M
NEW

NODE=M134M;LINKAGE=B
NODE=M134M;LINKAGE=A
NODE=M134M;LINKAGE=ZU
NODE=M134M;LINKAGE=A1

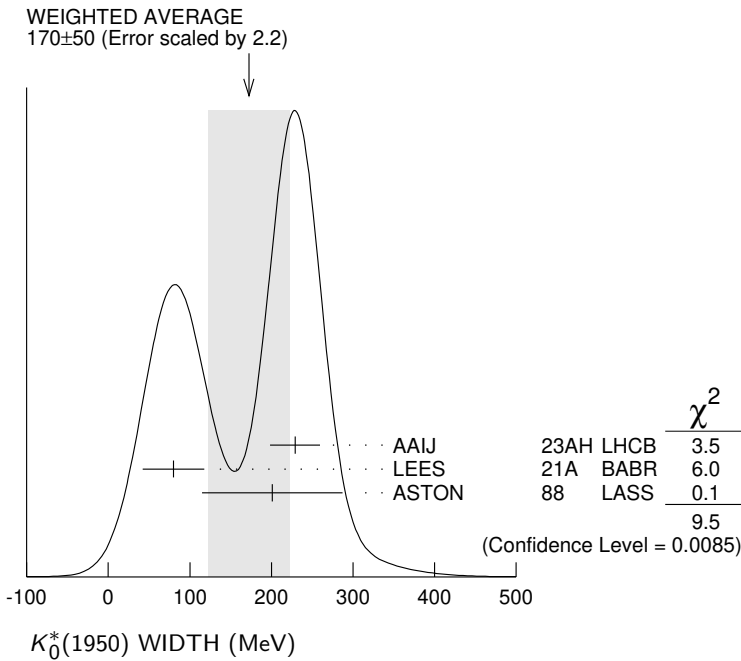
$K_0^*(1950)$ WIDTH

NODE=M134W

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
170± 50 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.				
[100 ± 40 MeV OUR 2023 AVERAGE Scale factor = 1.3]				
229± 26±16	¹ AAIJ	23AH	LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
80± 32±20	LEES	21A	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow \eta' K^+ K^-$
201± 34±79	² ASTON	88	LASS 0	$11 K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
145± 38	³ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
250±100	⁴ ANISOVICH	97C	RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$				
² We take the central value of the two solutions and the larger error given.				
³ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.				
⁴ T-matrix pole. Reanalysis of ASTON 88 data.				

NODE=M134W
NEW

NODE=M134W;LINKAGE=B
NODE=M134W;LINKAGE=A
NODE=M134W;LINKAGE=ZU
NODE=M134W;LINKAGE=A1



$K_0^*(1950)$ DECAY MODES

NODE=M134215;NODE=M134

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K^- \pi^+$	(52±14) %

DESIG=1

$K_0^*(1950)$ BRANCHING RATIOS

NODE=M134220

$\Gamma(K^- \pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.52±0.08±0.12	¹ ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 0.60	² ZHOU	06	RVUE		$K p \rightarrow K^- \pi^+ n$
¹ We take the central value of the two solutions and the larger error given.					
² S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.					

NODE=M134R1
NODE=M134R1

NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU

$K_0^*(1950)$ REFERENCES

NODE=M134

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ZHOU	06	NP A775 212	Z.Y. Zhou, H.Q. Zheng	
ANISOVICH	97C	PL B413 137	A.V. Anisovich, A.V. Sarantsev	
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

REFID=62349
REFID=61442
REFID=51198
REFID=45815
REFID=40262

NODE=M104

$K_2^*(1980)$

$$I(J^P) = \frac{1}{2}(2^+)$$

$K_2^*(1980)$ MASS

NODE=M104M

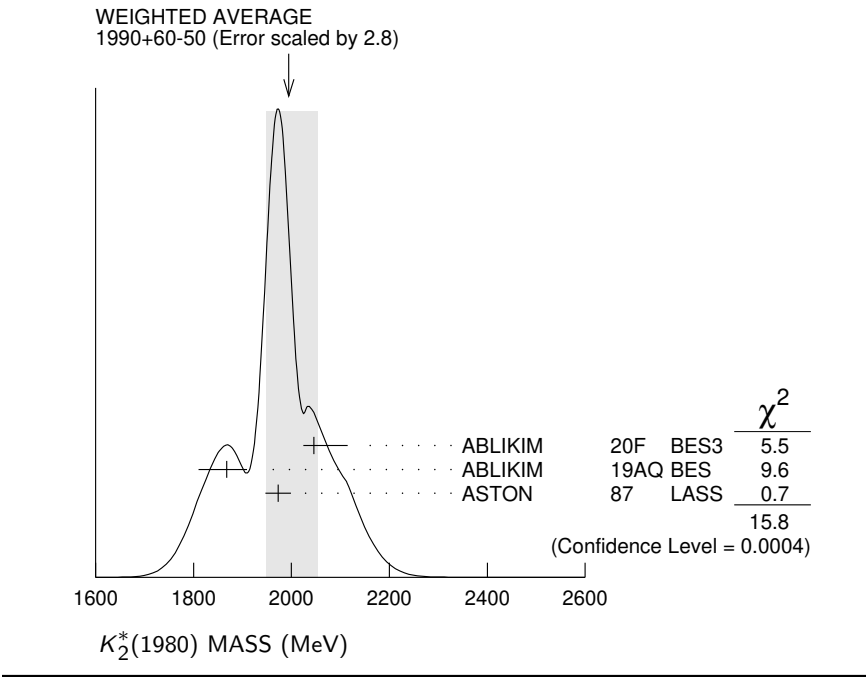
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1990⁺⁶⁰₋₅₀	OUR AVERAGE Error includes scale factor of 2.8. See the ideogram below.				
[1994 ⁺⁶⁰ ₋₅₀	MeV	OUR 2023 AVERAGE Scale factor = 2.8]			
2046 ⁺¹⁷⁺⁶⁷ ₋₁₆₋₁₅	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1868± 8 ⁺⁴⁰ ₋₅₇	183k	ABLIKIM	19AQBES	±	$J/\psi \rightarrow K^+ K^- \pi^0$
1973± 8± 25		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2073±94 ⁺²⁴⁵ ₋₂₄₀	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
2020±20		TIKHOMIROV	03	SPEC	40.0 $\pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1978±40	241	BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (7.0 \pm 0.5^{+3.7}_{-0.6}) \times 10^{-6}$.					
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4 σ .					
³ A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6 σ .					

NODE=M104M

NEW

NODE=M104M;LINKAGE=C

NODE=M104M;LINKAGE=B
NODE=M104M;LINKAGE=E



$K_2^*(1980)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
348^{+50}_{-30}	OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
408^{+38+72}_{-34-44}	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
$272 \pm 24^{+50}_{-15}$	183k	ABLIKIM	19AQ	BES	$J/\psi \rightarrow K^+ K^- \pi^0$
$373 \pm 33 \pm 60$		ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$678 \pm 311^{+1153}_{-559}$	4289	^{2,3} AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
180 ± 70		TIKHOMIROV	03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
398 ± 47	241	BIRD	89	LASS	- 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (7.0 \pm 0.5^{+3.7}_{-0.6}) \times 10^{-6}$.

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4σ .

³ A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6σ .

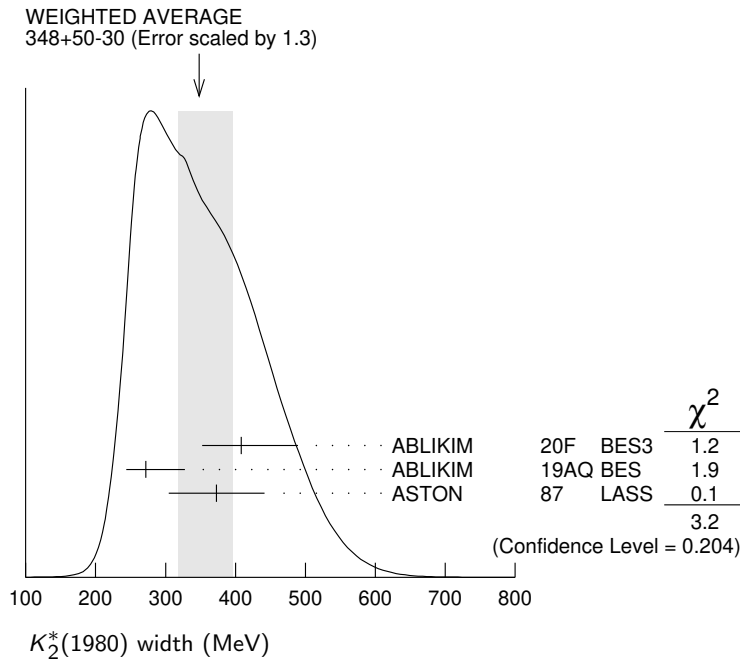
NODE=M104W

NODE=M104W

NODE=M104W;LINKAGE=C

NODE=M104W;LINKAGE=B

NODE=M104W;LINKAGE=E



$K_2^*(1980)$ DECAY MODES

NODE=M104215;NODE=M104

Mode	Fraction (Γ_i/Γ)
Γ_1 $K^*(892)\pi$	possibly seen
Γ_2 $K\rho$	possibly seen
Γ_3 $K f_2(1270)$	possibly seen
Γ_4 $K\phi$	seen
Γ_5 $K\eta$	seen

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$K_2^*(1980)$ BRANCHING RATIOS

NODE=M104220

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

NODE=M104R01
NODE=M104R01

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	GULER	11	BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

$\Gamma(K\rho)/\Gamma_{\text{total}}$ Γ_2/Γ

NODE=M104R02
NODE=M104R02

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	GULER	11	BELL $B^+ \rightarrow J/\psi K^+ \pi^+ \pi^-$

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$ Γ_2/Γ_1

NODE=M104R1
NODE=M104R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
$1.49 \pm 0.24 \pm 0.09$	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

$\Gamma(K f_2(1270))/\Gamma_{\text{total}}$ Γ_3/Γ

NODE=M104R3
NODE=M104R3

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	TIKHOMIROV 03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

$\Gamma(K\phi)/\Gamma_{\text{total}}$ Γ_4/Γ

NODE=M104R00
NODE=M104R00

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	4289	^{1,2} AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.4σ .

NODE=M104R00;LINKAGE=A
NODE=M104R00;LINKAGE=C

² A reanalysis by AAIJ 21E using a larger data sample did not confirm this measurement, the new result having a significance of only 1.6σ .

$\Gamma(K\eta)/\Gamma_{\text{total}}$ Γ_5/Γ

NODE=M104R03
NODE=M104R03

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	1.8k	¹ ABLIKIM	20F	BES3 $\psi(2S) \rightarrow K^+ K^- \eta$
seen	116k	² CHEN	20A	BELL $D^0 \rightarrow K^- \pi^+ \eta$

¹ Seen decaying to $K\eta$ in an amplitude analysis of $\psi(2S) \rightarrow K^+ K^- \eta$.

NODE=M104R03;LINKAGE=A
NODE=M104R03;LINKAGE=B

² From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 17σ .

K*(1980) REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
GULER	11	PR D83 032005	H. Guler <i>et al.</i>	(BELLE Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
		Translated from YAF 66 860.		
BIRD	89	SLAC-332	P.F. Bird	(SLAC)
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M104

REFID=61150
REFID=60256
REFID=60333
REFID=59909
REFID=57657
REFID=57636
REFID=53668
REFID=49423

REFID=41002
REFID=40234

NODE=M035

K*(2045)

I(J^P) = 1/2(4⁺)

K*(2045) MASS

NODE=M035M

NODE=M035M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2048 ⁺⁸ ₋₉	OUR AVERAGE	Error includes scale factor of 1.1.			
2090 [±]	9 ⁺¹¹ ₋₂₉	183k	ABLIKIM	19AQ BES	± J/ψ → K ⁺ K ⁻ π ⁰
2062 [±]	14 [±] 13		¹ ASTON	86 LASS	0 11 K ⁻ p → K ⁻ π ⁺ n
2039 [±]	10	400	^{2,3} CLELAND	82 SPEC	± 50 K ⁺ p → K ⁰ _S π [±] p
2070 ⁺¹⁰⁰ ₋₄₀			⁴ ASTON	81C LASS	0 11 K ⁻ p → K ⁻ π ⁺ n
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2079 [±]	7	431	TORRES	86 MPSF	400 pA → 4KX
2088 [±]	20	650	BAUBILLIER	82 HBC	- 8.25 K ⁻ p → K ⁰ _S π ⁻ p
2115 [±]	46	488	CARMONY	77 HBC	0 9 K ⁺ d → K ⁺ π ^{'s} X
¹ From a fit to all moments. ² From a fit to 8 moments. ³ Number of events evaluated by us. ⁴ From energy-independent partial-wave analysis.					

NODE=M035M;LINKAGE=E
NODE=M035M;LINKAGE=B
NODE=M035M;LINKAGE=W
NODE=M035M;LINKAGE=D

K*(2045) WIDTH

NODE=M035W

NODE=M035W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
199 ⁺²⁷ ₋₁₉	OUR AVERAGE				
201 [±]	19 ⁺⁵⁷ ₋₁₇	183k	ABLIKIM	19AQ BES	± J/ψ → K ⁺ K ⁻ π ⁰
221 [±]	48 [±] 27		⁵ ASTON	86 LASS	0 11 K ⁻ p → K ⁻ π ⁺ n
189 [±]	35	400	^{6,7} CLELAND	82 SPEC	± 50 K ⁺ p → K ⁰ _S π [±] p
• • • We do not use the following data for averages, fits, limits, etc. • • •					
61 [±]	58	431	TORRES	86 MPSF	400 pA → 4KX
170 ⁺¹⁰⁰ ₋₅₀		650	BAUBILLIER	82 HBC	- 8.25 K ⁻ p → K ⁰ _S π ⁻ p
240 ⁺⁵⁰⁰ ₋₁₀₀			⁸ ASTON	81C LASS	0 11 K ⁻ p → K ⁻ π ⁺ n
300 [±] 200			CARMONY	77 HBC	0 9 K ⁺ d → K ⁺ π ^{'s} X
⁵ From a fit to all moments. ⁶ From a fit to 8 moments. ⁷ Number of events evaluated by us. ⁸ From energy-independent partial-wave analysis.					

NODE=M035W;LINKAGE=E
NODE=M035W;LINKAGE=B
NODE=M035W;LINKAGE=W
NODE=M035W;LINKAGE=D

K*(2045) DECAY MODES

NODE=M035215;NODE=M035

Mode	Fraction (Γ _i /Γ)
Γ ₁ K π	(9.9±1.2) %
Γ ₂ K*(892) π π	(9 ±5) %
Γ ₃ K*(892) π π π	(7 ±5) %
Γ ₄ ρ K π	(5.7±3.2) %
Γ ₅ ω K π	(5.0±3.0) %
Γ ₆ φ K π	(2.8±1.4) %
Γ ₇ φ K*(892)	(1.4±0.7) %

DESIG=1
DESIG=2
DESIG=5
DESIG=3
DESIG=4
DESIG=6
DESIG=7

$K_4^*(2045)$ BRANCHING RATIOS

NODE=M035220

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.099±0.012	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$

NODE=M035R1
NODE=M035R1

$\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.89±0.53	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$

NODE=M035R2
NODE=M035R2

$\Gamma(K^*(892)\pi\pi\pi)/\Gamma(K\pi)$					Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.75±0.49	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$

NODE=M035R5
NODE=M035R5

$\Gamma(\rho K\pi)/\Gamma(K\pi)$					Γ_4/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.58±0.32	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$

NODE=M035R3
NODE=M035R3

$\Gamma(\omega K\pi)/\Gamma(K\pi)$					Γ_5/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.50±0.30	BAUBILLIER	82	HBC	—	8.25 $K^- p \rightarrow p K_S^0 3\pi$

NODE=M035R4
NODE=M035R4

$\Gamma(\phi K\pi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.028±0.014	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$	

NODE=M035R6
NODE=M035R6

$\Gamma(\phi K^*(892))/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.014±0.007	⁹ TORRES	86	MPSF	400 $pA \rightarrow 4KX$	

NODE=M035R7
NODE=M035R7

⁹ Error determination is model dependent.

NODE=M035R;LINKAGE=A

$K_4^*(2045)$ REFERENCES

NODE=M035

ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
TORRES	86	PR D34 707	S. Torres <i>et al.</i>	(VPI, ARIZ, FNAL, FSU+)
BAUBILLIER	82	PL 118B 447	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81C	PL 106B 235	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
CARMONY	77	PR D16 1251	D.D. Carmony <i>et al.</i>	(PURD, UCD, IUPU)

REFID=59909
REFID=40262
REFID=22462
REFID=22845
REFID=22842
REFID=22455
REFID=22821
REFID=22811

K₂(2250)

$I(J^P) = \frac{1}{2}(2^-)$

OMITTED FROM SUMMARY TABLE

This entry contains various peaks in strange meson systems reported in the 2150–2260 MeV region, as well as enhancements seen in the antihyperon-nucleon system, either in the mass spectra or in the $J^P = 2^-$ wave.

NODE=M040

NODE=M040

NODE=M040M

NODE=M040M

NODE=M040M;LINKAGE=Q

NODE=M040W

NODE=M040W

NODE=M040W;LINKAGE=Q

NODE=M040215;NODE=M040

DESIG=1

DESIG=3

DESIG=4

DESIG=2

NODE=M040

REFID=49423

REFID=22852

REFID=22850

REFID=22851

REFID=22849

REFID=22847

K₂(2250) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
2247±17 OUR AVERAGE						
2200±40		¹ ARMSTRONG 83C	OMEG	–	18 $K^- p \rightarrow \Lambda \bar{p} X$	
2235±50		¹ BAUBILLIER 81	HBC	–	8 $K^- p \rightarrow \Lambda \bar{p} X$	
2260±20		¹ CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
2280±20		TIKHOMIROV 03	SPEC		$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
2147± 4	37	CHLIAPNIK...	79	HBC	+	32 $K^+ p \rightarrow \bar{\Lambda} p X$
2240±20	20	LISSAUER 70	HBC			9 $K^+ p$
¹ $J^P = 2^-$ from moments analysis.						

K₂(2250) WIDTH

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
180±30 OUR AVERAGE						
Error includes scale factor of 1.4.						
150±30		² ARMSTRONG 83c	OMEG	–	18 $K^- p \rightarrow \Lambda \bar{p} X$	
210±30		² CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
180±60		TIKHOMIROV 03	SPEC		40.0 $\pi^- C \rightarrow$ $K_S^0 K_S^0 K_L^0 X$	
~ 200		² BAUBILLIER 81	HBC	–	8 $K^- p \rightarrow \Lambda \bar{p} X$	
~ 40	37	CHLIAPNIK...	79	HBC	+	32 $K^+ p \rightarrow \bar{\Lambda} p X$
80±20	20	LISSAUER 70	HBC		9 $K^+ p$	
² $J^P = 2^-$ from moments analysis.						

K₂(2250) DECAY MODES

Mode	
Γ ₁	$K \pi \pi$
Γ ₂	$K f_2(1270)$
Γ ₃	$K^*(892) f_0(980)$
Γ ₄	$\rho \bar{\Lambda}$

K₂(2250) REFERENCES

TIKHOMIROV 03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
	Translated from YAF 66 860.		
ARMSTRONG 83C	NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
BAUBILLIER 81	NP B183 1	M. Baubillier <i>et al.</i>	(BIRM, CERN, GLAS+) JP
CLELAND 81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+) JP
CHLIAPNIK...	NP B158 253	P.V. Chliapnikov <i>et al.</i>	(CERN, BELG, MONS)
LISSAUER 70	NP B18 491	D. Lissauer <i>et al.</i>	(LBL)

$K_3(2320)$

$I(J^P) = \frac{1}{2}(3^+)$

OMITTED FROM SUMMARY TABLE
Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

$K_3(2320)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2324±24 OUR AVERAGE				
2330±40	¹ ARMSTRONG 83C	OMEG	—	18 $K^- p \rightarrow \Lambda \bar{p} X$
2320±30	¹ CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$
¹ $J^P = 3^+$ from moments analysis.				

$K_3(2320)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
150±30	² ARMSTRONG 83C	OMEG	—	18 $K^- p \rightarrow \Lambda \bar{p} X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	² CLELAND 81	SPEC	±	50 $K^+ p \rightarrow \Lambda \bar{p} X$
² $J^P = 3^+$ from moments analysis.				

$K_3(2320)$ DECAY MODES

Mode
$\Gamma_1 \quad p \bar{\Lambda}$

$K_3(2320)$ REFERENCES

ARMSTRONG 83C NP B227 365	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)
CLELAND 81 NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

$K_5^*(2380)$

$I(J^P) = \frac{1}{2}(5^-)$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

$K_5^*(2380)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2382±14±19	¹ ASTON 86	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
¹ From a fit to all the moments.				

$K_5^*(2380)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
180±50 OUR AVERAGE	[178 ± 50 MeV OUR 2023 AVERAGE]			
178±37±32	² ASTON 86	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$
² From a fit to all the moments.				

$K_5^*(2380)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K \pi$	(6.1±1.2) %

NODE=M090

NODE=M090

NODE=M090M

NODE=M090M

NODE=M090M;LINKAGE=P

NODE=M090W

NODE=M090W

NODE=M090W;LINKAGE=P

NODE=M090215;NODE=M090

DESIG=1

NODE=M090

REFID=22852
REFID=22851

NODE=M098

NODE=M098

NODE=M098M

NODE=M098M

NODE=M098M;LINKAGE=E

NODE=M098W

NODE=M098W
NEW

NODE=M098W;LINKAGE=E

NODE=M098215;NODE=M098

DESIG=1

$K_5^*(2380)$ BRANCHING RATIOS

$\Gamma(K\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.061 ± 0.012	ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	

NODE=M098220

NODE=M098R1
NODE=M098R1

$K_5^*(2380)$ REFERENCES

ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
ASTON	86	PL B180 308	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)

NODE=M098

REFID=40262
REFID=22462

NODE=M091

$K_4(2500)$

$I(J^P) = \frac{1}{2}(4^-)$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M091

$K_4(2500)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
2490 ± 20	¹ CLELAND	81	SPEC	$\pm$ 50 $K^+ p \rightarrow \Lambda \bar{p}$
¹ $J^P = 4^-$ from moments analysis.				

NODE=M091M

NODE=M091M

NODE=M091M;LINKAGE=R

$K_4(2500)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 250	² CLELAND	81	SPEC	$\pm$ 50 $K^+ p \rightarrow \Lambda \bar{p}$
² $J^P = 4^-$ from moments analysis.				

NODE=M091W

NODE=M091W

NODE=M091W;LINKAGE=R

$K_4(2500)$ DECAY MODES

NODE=M091215;NODE=M091

Mode
$\Gamma_1 \quad p \bar{\Lambda}$

DESIG=1

$K_4(2500)$ REFERENCES

CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

NODE=M091

REFID=22851

$K(3100)$

$$I^G(J^{PC}) = ?^?(??)$$

OMITTED FROM SUMMARY TABLE

also known as $K_J^?(3100)$

Narrow peak observed in several ($\Lambda\bar{p}$ + pions) and ($\bar{\Lambda}p$ + pions) states in Σ^- Be reactions by BOURQUIN 86 and in np and nA reactions by ALEEV 93. Not seen by BOEHNLEIN 91. If due to strong decays, this state has exotic quantum numbers ($B=0, Q=+1, S=-1$ for $\Lambda\bar{p}\pi^+\pi^+$ and $I \geq 3/2$ for $\Lambda\bar{p}\pi^-\pi^-$). Needs confirmation.

NODE=M129

NODE=M129

 $K(3100)$ MASS

VALUE (MeV)

DOCUMENT ID

 ≈ 3100 OUR ESTIMATE

NODE=M129205

NODE=M129M

→ UNCHECKED ←

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

 3054 ± 11 OUR AVERAGE $3060 \pm 7 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$ $3056 \pm 7 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$ $3055 \pm 8 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$ $3045 \pm 8 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129M1

NODE=M129M1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

 3059 ± 11 OUR AVERAGE $3067 \pm 6 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$ $3060 \pm 8 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$ $3055 \pm 7 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$ $3052 \pm 8 \pm 20$ ¹ ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

NODE=M129M2

NODE=M129M2

OCCUR=2

OCCUR=3

OCCUR=4

• • • We do not use the following data for averages, fits, limits, etc. • • •

 3105 ± 30 BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$ 3115 ± 30 BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 3095 ± 30 BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ ¹ Supersedes ALEEV 90.

NODE=M129M3

NODE=M129M3

NODE=M129M;LINKAGE=A

 $K(3100)$ WIDTH

NODE=M129210

3-BODY DECAYS

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 42 ± 16 ² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+$ 36 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$ 50 ± 18 ² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$ 30 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

NODE=M129W1

NODE=M129W1

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 22 ± 8 ² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$ 28 ± 12 ² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$ 32 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$ 30 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

NODE=M129W2

NODE=M129W2

OCCUR=2

OCCUR=3

OCCUR=4

<30 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+$

<80 90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

5-BODY DECAYS

VALUE (MeV)

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30

90

BOURQUIN 86 SPEC $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^+\pi^-$ ² Supersedes ALEEV 90.

NODE=M129W3

NODE=M129W3

NODE=M129W;LINKAGE=A

K(3100) DECAY MODES

NODE=M129215;NODE=M129

Mode	
Γ_1	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+$
Γ_2	$K(3100)^{--} \rightarrow \Lambda \bar{p} \pi^-$
Γ_3	$K(3100)^- \rightarrow \Lambda \bar{p} \pi^+ \pi^-$
Γ_4	$K(3100)^+ \rightarrow \Lambda \bar{p} \pi^+ \pi^+$
Γ_5	$K(3100)^0 \rightarrow \Lambda \bar{p} \pi^+ \pi^+ \pi^-$
Γ_6	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$\Gamma(\Sigma(1385)^+ \bar{p})/\Gamma(\Lambda \bar{p} \pi^+)$					Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.04	90	ALEEV	93	BIS2	$K(3100)^0 \rightarrow \Sigma(1385)^+ \bar{p}$

NODE=M129R1

NODE=M129R1

K(3100) REFERENCES

ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
		Translated from YAF 56 100.		
BOEHNLEIN	91	NPBPS B21 174	A. Boehnlein <i>et al.</i>	(FLOR, BNL, IND+)
ALEEV	90	ZPHY C47 533	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)
BOURQUIN	86	PL B172 113	M.H. Bourquin <i>et al.</i>	(GEVA, RAL, HEIDP+)

NODE=M129

REFID=43668

REFID=41743

REFID=42173

REFID=22928

CHARMED MESONS **(C = ±1)**

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}s$$

NODE=MXXX035

NODE=MXXX035

NODE=M061

$$D^*(2007)^0$$

$$I(J^P) = \frac{1}{2}(1^-)$$

$$J^P = 1^- \text{ established by ABLIKIM 23AZ.}$$

NODE=M061

D*(2007)⁰ MASS

NODE=M061M

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061M

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2006.85±0.05 OUR FIT	Error includes scale factor of 1.1.		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
2006 ±1.5	¹ GOLDHABER 77	MRK1	e ⁺ e ⁻
¹ From simultaneous fit to D [*] (2010) ⁺ , D [*] (2007) ⁰ , D ⁺ , and D ⁰ .			

NODE=M061M

NODE=M061M;LINKAGE=G

m_{D*(2007)⁰} - m_{D⁰}

NODE=M061DM

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M061DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
142.014±0.030 OUR FIT	Error includes scale factor of 1.5.			
142.016±0.030 OUR AVERAGE	Error includes scale factor of 1.5.			
142.007±0.015±0.014	10k	¹ TOMARADZE 15	CLEO	$e^+e^- \rightarrow \text{hadrons}$
142.2 ±0.3 ±0.2	145	ALBRECHT 95F	ARG	$e^+e^- \rightarrow \text{hadrons}$
142.12 ±0.05 ±0.05	1176	BORTOLETTO92B	CLE2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
142.2 ±2.0		SADROZINSKI 80	CBAL	$D^{*0} \rightarrow D^0 \pi^0$
142.7 ±1.7		² GOLDHABER 77	MRK1	e^+e^-

NODE=M061DM

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration . This value comes from the average of the results for two decay modes, $D^0 \rightarrow K^- \pi^+$ and $D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$.

² From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

NODE=M061DM;LINKAGE=A

NODE=M061DM;LINKAGE=G

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

NODE=M061220;NODE=M061

NODE=M061

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

¹ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1$ MeV/ c^2 .

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^0 \pi^0$	(64.7 $\pm$ 0.9) %	
Γ_2 $D^0 \gamma$	(35.3 $\pm$ 0.9) %	
Γ_3 $D^0 e^+ e^-$	(3.91 $\pm$ 0.33) $\times 10^{-3}$	
Γ_4 $\mu^+ \mu^-$	< 2.5 $\times 10^{-8}$	90%
Γ_5 $e^+ e^-$	< 1.7 $\times 10^{-6}$	90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 5 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 = 2.5$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

$$x_2 \begin{vmatrix} -100 \\ x_1 \end{vmatrix}$$

$D^*(2007)^0$ BRANCHING RATIOS

NODE=M061225

$\Gamma(D^0 \pi^0) / \Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
0.647 $\pm$ 0.009 OUR FIT						
[0.647 $\pm$ 0.009 OUR 2023 FIT]						

NODE=M061R2
NODE=M061R2
NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.655 $\pm$ 0.008 $\pm$ 0.005	3.2k	¹ ABLIKIM	15B BES3	$e^+ e^- \rightarrow$ hadrons
0.635 $\pm$ 0.003 $\pm$ 0.017	69k	¹ AUBERT,BE	05G BABR	10.6 $e^+ e^- \rightarrow$ hadrons
0.596 $\pm$ 0.035 $\pm$ 0.028	858	² ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.636 $\pm$ 0.023 $\pm$ 0.033	1097	² BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons

¹ Derived from the ratio $\Gamma(D^0 \pi^0) / \Gamma(D^0 \gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0 \pi^0$ and $D^{*0} \rightarrow D^0 \gamma$ decays sum to 100%.

² The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R2;LINKAGE=AU

NODE=M061R2;LINKAGE=A

$\Gamma(D^0 \gamma) / \Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
0.353 $\pm$ 0.009 OUR FIT						
[0.353 $\pm$ 0.009 OUR 2023 FIT]						

NODE=M061R1
NODE=M061R1
NEW

0.381 $\pm$ 0.029 OUR AVERAGE

0.404 $\pm$ 0.035 $\pm$ 0.028	456	¹ ALBRECHT	95F ARG	$e^+ e^- \rightarrow$ hadrons
0.364 $\pm$ 0.023 $\pm$ 0.033	621	¹ BUTLER	92 CLE2	$e^+ e^- \rightarrow$ hadrons
0.37 $\pm$ 0.08 $\pm$ 0.08		ADLER	88D MRK3	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.345 ± 0.008 ± 0.005	1.8k	² ABLIKIM	15B	BES3	$e^+e^- \rightarrow \text{hadrons}$
0.365 ± 0.003 ± 0.017	68k	² AUBERT,BE	05G	BABR	10.6 $e^+e^- \rightarrow \text{hadrons}$
0.47 ± 0.23		LOW	87	HRS	29 GeV e^+e^-
0.53 ± 0.13		BARTEL	85G	JADE	e^+e^- , hadrons
0.47 ± 0.12		COLES	82	MRK2	e^+e^-
0.45 ± 0.15		GOLDHABER	77	MRK1	e^+e^-

¹ The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Derived from the ratio $\Gamma(D^0\pi^0) / \Gamma(D^0\gamma)$ assuming that the branching fractions of $D^{*0} \rightarrow D^0\pi^0$ and $D^{*0} \rightarrow D^0\gamma$ decays sum to 100%.

$\Gamma(D^0\pi^0)/\Gamma(D^0\gamma)$

Γ_1/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

1.83 ± 0.07 OUR FIT

[1.83 ± 0.07 OUR 2023 FIT Scale factor = 1.1]

1.85 ± 0.07 OUR AVERAGE

1.90 ± 0.07 ± 0.05	4.9k	ABLIKIM	15B	BES3	10.6 $e^+e^- \rightarrow \text{hadrons}$
1.74 ± 0.02 ± 0.13		AUBERT,BE	05G	BABR	10.6 $e^+e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.789 ± 0.082	¹ AAIJ	22N	LHCB	$B^0, B_s^0 \rightarrow \bar{D}^{*0}(K\pi, \pi\pi)$

¹ Statistical error only.

$\Gamma(D^0e^+e^-)/\Gamma(D^0\gamma)$

Γ_3/Γ_2

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

11.08 ± 0.76 ± 0.49 421 ABLIKIM 21BD BES3 4.178 GeV e^+e^-

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$

Γ_4/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 2.5 × 10⁻⁸ 90 ¹ AAIJ 23D LHCB $B^- \rightarrow \pi^- \mu^+ \mu^-$

¹ AAIJ 23D reports $< 2.6 \times 10^{-8}$ from a measurement of $[\Gamma(D^{*}(2007)^0 \rightarrow \mu^+\mu^-)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \bar{D}^{*}(2007)^0\pi^+)]$ assuming $B(B^+ \rightarrow \bar{D}^{*}(2007)^0\pi^+) = (4.90 \pm 0.17) \times 10^{-3}$, which we rescale to our best value $B(B^+ \rightarrow \bar{D}^{*}(2007)^0\pi^+) = 5.17 \times 10^{-3}$. The reported value also assumes $B(B^- \rightarrow J/\psi(1S)K^-) = (10.20 \pm 0.19) \times 10^{-4}$ and $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (59.61 \pm 0.33) \times 10^{-3}$ for the normalization mode $B^- \rightarrow J/\psi(1S)K^-$.

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$

Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1.7 × 10⁻⁶ 90 SHEMYAKIN 20 CMD3 $e^+e^- \rightarrow D^0\pi^0, D^0\gamma$

$D^{*}(2007)^0$ REFERENCES

AAIJ	23D	EPJ C83 666	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP
AAIJ	22N	PR D105 072005	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	21BD	PR D104 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
SHEMYAKIN	20	PAN 83 954	D.N. Shemyakin	(CMD-3 Collab.)
ABLIKIM	15B	PR D91 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
TOMARADZE	15	PR D91 011102	A. Tomaradze <i>et al.</i>	(NWES)
AUBERT,BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
LOW	87	PL B183 232	E.H. Low <i>et al.</i>	(HRS Collab.)
BARTEL	85G	PL 161B 197	W. Bartel <i>et al.</i>	(JADE Collab.)
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
SADROZINSKI	80	Madison Conf. 681	H.F.W. Sadrozinski <i>et al.</i>	(PRIN, CIT+)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)

NODE=M061R;LINKAGE=A

NODE=M061R;LINKAGE=AU

NODE=M061R3
NODE=M061R3
NEW

NODE=M061R3;LINKAGE=A

NODE=M061R00
NODE=M061R00

NODE=M061R01
NODE=M061R01

NODE=M061R01;LINKAGE=A

NODE=M061R02
NODE=M061R02

NODE=M061

REFID=62095
REFID=62420
REFID=61737
REFID=61535
REFID=62315
REFID=56375
REFID=57142
REFID=50942
REFID=44374
REFID=43116
REFID=43170
REFID=40584
REFID=40579
REFID=40017
REFID=22880
REFID=22866
REFID=22877
REFID=11434

$D^*(2010)^\pm$

$$I(J^P) = \frac{1}{2}(1^-)$$

 $J^P = 1^-$ established by ABLIKIM 23AZ.

NODE=M062

NODE=M062

NODE=M062M

NODE=M062M

NODE=M062M

 $D^*(2010)^\pm$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

2010.26±0.05 OUR FIT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2008 ±3	¹ GOLDBABER 77	MRK1	±	e^+e^-
2008.6 ±1.0	² PERUZZI 77	LGW	±	e^+e^-

¹ From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 ; not independent of FELDMAN 77B mass difference below.

² PERUZZI 77 mass not independent of FELDMAN 77B mass difference below and PERUZZI 77 D^0 mass value.

NODE=M062M;LINKAGE=G

NODE=M062M;LINKAGE=P

 $m_{D^*(2010)^+} - m_{D^+}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062MD

NODE=M062MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

140.603 ±0.015 OUR FIT**140.602 ±0.014 OUR AVERAGE**

140.6010±0.0068±0.0129	151k	LEES	17F BABR	$e^+e^- \rightarrow \text{hadrons}$
140.64 ±0.08 ±0.06	620	BORTOLETTO92B	CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M062MD

 $m_{D^*(2010)^+} - m_{D^0}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M062DM

NODE=M062DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

145.4258±0.0017 OUR FIT

[145.4258 ± 0.0017 MeV OUR 2023 FIT]

145.4258±0.0020 OUR AVERAGE Error includes scale factor of 1.2.

145.4259±0.0004±0.0017	312.8k	LEES	13X BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi, K 3 \pi) \pi^\pm$
145.412 ±0.002 ±0.012		ANASTASSOV 02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
145.54 ±0.08	611	¹ ADINOLFI 99	BEAT	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.45 ±0.02		¹ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$
145.42 ±0.05		¹ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 3 \pi) \pi^\pm$
145.5 ±0.15	103	² ADLOFF 97B	H1	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.44 ±0.08	152	² BREITWEG 97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm, D^0 \rightarrow K^- 3 \pi$
145.42 ±0.11	199	² BREITWEG 97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm, D^0 \rightarrow K^- \pi^+$
145.4 ±0.2	48	² DERRICK 95	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.39 ±0.06 ±0.03		BARLAG 92B	ACCM	$\pi^- 230 \text{ GeV}$
145.5 ±0.2	115	² ALEXANDER 91B	OPAL	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.30 ±0.06		² DECAMP 91J	ALEP	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.40 ±0.05 ±0.10		ABACHI 88B	HRS	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.46 ±0.07 ±0.03		ALBRECHT 85F	ARG	$D^{*\pm} \rightarrow D^0 \pi^+$
145.5 ±0.3	28	BAILEY 83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.3	60	FITCH 81	SPEC	$\pi^- A$
145.3 ±0.5	30	FELDMAN 77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$

NODE=M062DM

NEW

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

145.4256±0.0006±0.0017	138.5k	LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+) \pi^\pm$
145.4266±0.0005±0.0019	174.3k	LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-) \pi^\pm$
145.44 ±0.09	122	² BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm, D^0 \rightarrow K^- \pi^+$
145.8 ±1.5	16	AHLEN	83	HRS	$D^{*+} \rightarrow D^0 \pi^+$
145.1 ±1.8	12	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.1 ±0.5	14	BAILEY	83	SPEC	$D^{*\pm} \rightarrow D^0 \pi^\pm$
145.5 ±0.5	14	YELTON	82	MRK2	$29 e^+ e^- \rightarrow K^- \pi^+$
~ 145.5		AVERY	80	SPEC	γA
145.2 ±0.6	2	BLIETSCHAU	79	BEBC	νp

¹ Statistical errors only.
² Systematic error not evaluated.

OCCUR=2

OCCUR=3

NODE=M062DM;LINKAGE=AV
NODE=M062DM;LINKAGE=A

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

NODE=M062EM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M062EM

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.6±1.8	¹ PERUZZI	77	LGW	$e^+ e^-$

¹ Not independent of FELDMAN 77B mass difference above, PERUZZI 77 D^0 mass, and GOLDHABER 77 $D^*(2007)^0$ mass.

NODE=M062EM;LINKAGE=P

$D^*(2010)^\pm$ WIDTH

NODE=M062W

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M062W

83.4±1.8 OUR AVERAGE

83.3±1.2±1.4	312.8k	¹ LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi, K 3\pi) \pi^\pm$
96 ±4 ±22		¹ ANASTASSOV	02	CLE2	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

83.4±1.7±1.5	138.5k	¹ LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+) \pi^\pm$
83.2±1.5±2.6	174.3k	¹ LEES	13X	BABR	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-) \pi^\pm$
<131	90	110	BARLAG	92B	ACCM π^- 230 GeV

OCCUR=2

¹ Ignoring the electromagnetic contribution from $D^{*\pm} \rightarrow D^\pm \gamma$.

NODE=M062W;LINKAGE=LE

$D^*(2010)^\pm$ DECAY MODES

NODE=M062225;NODE=M062

$D^*(2010)^-$ modes are charge conjugates of the modes below.

NODE=M062

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 \pi^+$	(67.7±0.5) %
Γ_2 $D^+ \pi^0$	(30.7±0.5) %
Γ_3 $D^+ \gamma$	(1.6±0.4) %

DESIG=1
DESIG=3
DESIG=2

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 6 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.3$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-62	
x_3	-43	-44
	x_1	x_2

$D^*(2010)^+$ BRANCHING RATIOS

NODE=M062230

$\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT		
0.677 $\pm$ 0.005 OUR FIT						NODE=M062R1
0.677 $\pm$ 0.006 OUR AVERAGE						NODE=M062R1
0.6759 $\pm$ 0.0029 $\pm$ 0.0064	^{1,2,3}	BARTELT	98	CLE2	e^+e^-	
0.688 $\pm$ 0.024 $\pm$ 0.013		ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons	
0.681 $\pm$ 0.010 $\pm$ 0.013	¹	BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.57 $\pm$ 0.04 $\pm$ 0.04		ADLER	88D	MRK3	e^+e^-	
0.44 $\pm$ 0.10		COLES	82	MRK2	e^+e^-	
0.6 $\pm$ 0.15	³	GOLDHABER	77	MRK1	e^+e^-	

¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

³ Assuming that isospin is conserved in the decay.

NODE=M062R1;LINKAGE=A

NODE=M062R1;LINKAGE=B

NODE=M062R1;LINKAGE=G

$\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.307 $\pm$ 0.005 OUR FIT						NODE=M062R3
0.3073 $\pm$ 0.0013 $\pm$ 0.0062						NODE=M062R3
	^{1,2,3}	BARTELT	98	CLE2	e^+e^-	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.312 $\pm$ 0.011 $\pm$ 0.008	1404	ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons	
0.308 $\pm$ 0.004 $\pm$ 0.008	410	¹ BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons	
0.26 $\pm$ 0.02 $\pm$ 0.02		ADLER	88D	MRK3	e^+e^-	
0.34 $\pm$ 0.07		COLES	82	MRK2	e^+e^-	

¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

³ Assuming that isospin is conserved in the decay.

NODE=M062R3;LINKAGE=A

NODE=M062R3;LINKAGE=B

NODE=M062R3;LINKAGE=G

$\Gamma(D^+\gamma)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
0.016 $\pm$ 0.004 OUR FIT						NODE=M062R2
0.016 $\pm$ 0.005 OUR AVERAGE						NODE=M062R2
0.0168 $\pm$ 0.0042 $\pm$ 0.0029		^{1,2}	BARTELT	98	CLE2	e^+e^-
0.011 $\pm$ 0.014 $\pm$ 0.016		¹	BUTLER	92	CLE2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.052	90		ALBRECHT	95F	ARG	$e^+e^- \rightarrow$ hadrons
0.17 $\pm$ 0.05 $\pm$ 0.05			ADLER	88D	MRK3	e^+e^-
0.22 $\pm$ 0.12		³	COLES	82	MRK2	e^+e^-

¹ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

² Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

³ Not independent of $\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$ and $\Gamma(D^+\pi^0)/\Gamma_{\text{total}}$ measurement.

NODE=M062R2
NODE=M062R2

NODE=M062R2;LINKAGE=A

NODE=M062R2;LINKAGE=B

NODE=M062R2;LINKAGE=C

 $D^*(2010)^\pm$ REFERENCES

NODE=M062

ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=62420
LEES	17F	PRL 119 202003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58277
LEES	13X	PRL 111 111801	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55564
Also		PR D88 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55547
Also		PR D88 079902 (err.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55695
ANASTASSOV	02	PR D65 032003	A. Anastassov <i>et al.</i>	(CLEO Collab.)	REFID=48550
ADINOLFI	99	NP B547 3	M. Adinolfi <i>et al.</i>	(Beatrice Collab.)	REFID=46925
BREITWEG	99	EPJ C6 67	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46604
BARTELT	98	PRL 80 3919	J. Bartelt <i>et al.</i>	(CLEO Collab.)	REFID=46349
ADLOFF	97B	ZPHY C72 593	C. Adloff <i>et al.</i>	(H1 Collab.)	REFID=45421
BREITWEG	97	PL B401 192	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=45520
BREITWEG	97B	PL B407 402	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=45699
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44374
DERRICK	95	PL B349 225	M. Derrick <i>et al.</i>	(ZEUS Collab.)	REFID=44373
BARLAG	92B	PL B278 480	S. Barlag <i>et al.</i>	(ACCMOR Collab.)	REFID=42174
BORTOLETTO	92B	PRL 69 2046	D. Bortoletto <i>et al.</i>	(CLEO Collab.)	REFID=43116
BUTLER	92	PRL 69 2041	F. Butler <i>et al.</i>	(CLEO Collab.)	REFID=43170

ALEXANDER	91B	PL B262 341	G. Alexander <i>et al.</i>	(OPAL Collab.)
DECAMP	91J	PL B266 218	D. Decamp <i>et al.</i>	(ALEPH Collab.)
ABACHI	88B	PL B212 533	S. Abachi <i>et al.</i>	(ANL, IND, MICH, PURD+)
ADLER	88D	PL B208 152	J. Adler <i>et al.</i>	(Mark III Collab.)
ALBRECHT	85F	PL 150B 235	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
AHLEN	83	PRL 51 1147	S.P. Ahlen <i>et al.</i>	(ANL, IND, LBL+)
BAILEY	83	PL 132B 230	R. Bailey <i>et al.</i>	(AMST, BRIS, CERN, CRAC+)
COLES	82	PR D26 2190	M.W. Coles <i>et al.</i>	(LBL, SLAC)
YELTON	82	PRL 49 430	J.M. Yelton <i>et al.</i>	(SLAC, LBL, UCB+)
FITCH	81	PRL 46 761	V.L. Fitch <i>et al.</i>	(PRIN, SACL, TORI+)
AVERY	80	PRL 44 1309	P. Avery <i>et al.</i>	(ILL, FNAL, COLU)
BLIETSCHAU	79	PL 86B 108	J. Blietschau <i>et al.</i>	(AACH3, BONN, CERN+)
FELDMAN	77B	PRL 38 1313	G.J. Feldman <i>et al.</i>	(Mark I Collab.)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)
PERUZZI	77	PRL 39 1301	I. Peruzzi <i>et al.</i>	(LGW Collab.)

REFID=41553
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REFID=22866
REFID=22867
REFID=22863
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REFID=22858
REFID=11434
REFID=11435

NODE=M252

$D_0^*(2300)$

$I(J^P) = \frac{1}{2}(0^+)$

was $D_0^*(2400)$

There is a strong evidence that recent data on $B \rightarrow D\pi\pi$ (AAIJ 15Y, AAIJ 16AH) and $B \rightarrow D\pi K$ (AAIJ 14BH, AAIJ 15V, AAIJ 15X) call for two poles in the scalar $I = 1/2 \pi D$ amplitude in this mass range. The data are consistent with a lower pole at $(2105^{+6}_{-8}) - i(102^{+10}_{-11})$ MeV and a higher pole at $(2451^{+35}_{-26}) - i(134^{+7}_{-8})$ MeV (DU 18A, DU 19, DU 21). For details see review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M252

$D_0^*(2300)$ MASS

NODE=M252M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2343±10 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
2360±15±30		¹ AAIJ	15X LHCb	+	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2349± 6± 4		² AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2297± 8±20	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2308±17±32		ABE	04D BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2354± 7±11		³ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2403±14±35	18.8k	⁴ LINK	04A FOCS	+	γA
2407±21±35	9.8k	⁴ LINK	04A FOCS	0	γA

NODE=M252M

OCCUR=2

OCCUR=2

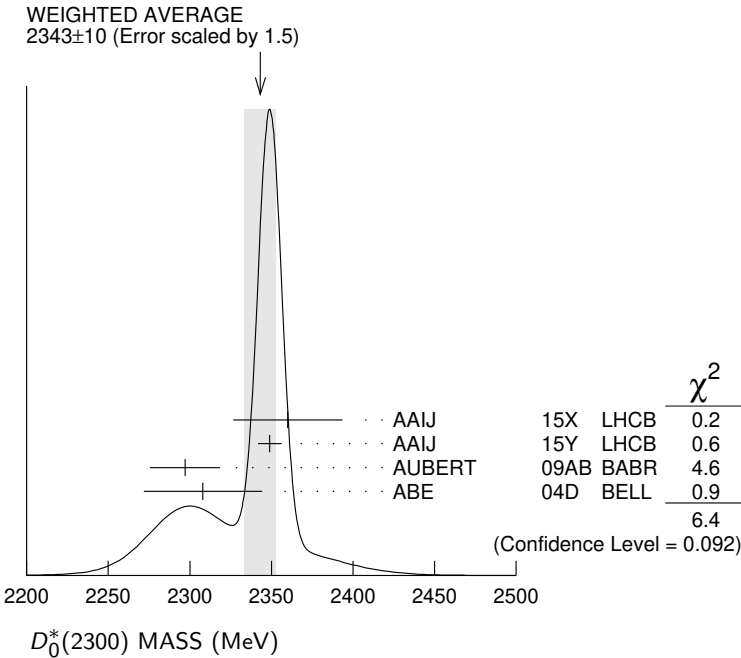
- ¹ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.
- ² Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.
- ³ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.
- ⁴ Possibly the feed-down from another state.

NODE=M252M;LINKAGE=A

NODE=M252M;LINKAGE=B

NODE=M252M;LINKAGE=C

NODE=M252M;LINKAGE=D



D*0(2300) WIDTH

NODE=M252W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
229±16 OUR AVERAGE						
255±26±51		¹ AAIJ	15X	LHCB	+	$B^0 \rightarrow \overline{D}^0 K^+ \pi^-$
217±13±13		² AAIJ	15Y	LHCB	+	$B^0 \rightarrow \overline{D}^0 \pi^+ \pi^-$
273±12±48	3.4k	AUBERT	09AB	BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
276±21±63		ABE	04D	BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
230±15±21		³ AAIJ	15Y	LHCB	+	$B^0 \rightarrow \overline{D}^0 \pi^+ \pi^-$
283±24±34	18.8k	⁴ LINK	04A	FOCS	+	γ A
240±55±59	9.8k	⁴ LINK	04A	FOCS	0	γ A

NODE=M252W

OCCUR=2

OCCUR=2

NODE=M252W;LINKAGE=A

NODE=M252W;LINKAGE=B
NODE=M252W;LINKAGE=C
NODE=M252W;LINKAGE=D

¹ From the Dalitz plot analysis including various K* and D** mesons as well as broad structures in the K π S-wave and the D π S- and P-waves.
² Modeling the π⁺ π⁻ S-wave with the Isobar formalism.
³ Modeling the π⁺ π⁻ S-wave with the K-matrix formalism.
⁴ Possibly the feed-down from another state.

D*0(2300) DECAY MODES

NODE=M252215;NODE=M252

Mode	Fraction (Γ _i /Γ)
Γ ₁ D π [±]	seen

DESIG=1

$\Gamma(D\pi^\pm)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen		AAIJ	15X	LHCB	+	$D^*(2300)^+ \rightarrow D^0 \pi^+$
seen		AAIJ	15Y	LHCB	+	$D^*(2300)^+ \rightarrow D^0 \pi^+$
seen	3.4k	AUBERT	09AB	BABR	0	$D^*(2300)^0 \rightarrow D^+ \pi^-$
seen		ABE	04D	BELL	0	$D^*(2300)^0 \rightarrow D^+ \pi^-$
seen	18.8k	LINK	04A	FOCS	+	$D^*(2300)^+ \rightarrow D^0 \pi^+$

NODE=M252R01
NODE=M252R01

D*0(2300) REFERENCES

NODE=M252

DU	21	PRL 126 192001	M.-L. Du <i>et al.</i>	
DU	19	PR D99 114002	M.-L. Du, F.-K. Guo, U.-G. Meissner	
DU	18A	PR D98 094018	M.-L. Du <i>et al.</i>	
AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15V	PR D91 092002	R. Aaij <i>et al.</i>	(LHCb Collab.)
Also		PR D93 119901 (errat.)	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BH	PR D90 072003	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AB	PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

REFID=61096
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REFID=56588
REFID=56609
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REFID=52941
REFID=50011
REFID=49775

$D_1(2420)$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M253

 $D_1(2420)$ MASS

NODE=M253M

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M253M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2422.1±0.6 OUR FIT Error includes scale factor of 1.7. [2422.1 ± 0.6 MeV OUR 2023 FIT Scale factor = 1.7]					
2422.1±0.8 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.					
2424.8±0.1±0.7	79k	¹ AAIJ	20D LHCb	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2427.2±1.0±1.2	4207	ABLIKIM	20P BES3	+	$e^+ e^- \rightarrow D^+ D^- \pi^+ \pi^-$
2419.6±0.1±0.7	210k	AAIJ	13CC LHCb	0	$p p \rightarrow D^{*+} \pi^- X$
2423.1±1.5 ^{+0.4} _{-1.0}	2.7k	² ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2421.9±4.7 ^{+3.4} _{-1.2}	759	³ ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2420.1±0.1±0.8	103k	DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2426 ±3 ±1	151	ABE	05A BELL	0	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
2421 ±2 ±1	124	ABE	05A BELL	+	$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
2421.4±1.5±0.9		⁴ ABE	04D BELL	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2421 ⁺¹ ₋₂ ±2	286	AVERY	94C CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2425 ±2 ±2	146	BERGFELD	94B CLE2	+	$e^+ e^- \rightarrow D^{*0} \pi^+ X$
2422 ±2 ±2	51	FRABETTI	94B E687	0	$\gamma \text{Be} \rightarrow D^{*+} \pi^- X$
2428 ±3 ±2	279	AVERY	90 CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2414 ±2 ±5	171	ALBRECHT	89H ARG	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2428 ±8 ±5	171	ANJOS	89C TPS	0	$\gamma N \rightarrow D^{*+} \pi^- X$
2443 ±7 ±5	190	ANJOS	89C TPS	+	$\gamma N \rightarrow D^0 \pi^+ X^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2420.5±2.1±0.9	3.1k	⁵ CHEKANOV	09 ZEUS	0	$e^\pm p \rightarrow D^{*+} \pi^- X$
2421.7±0.7±0.6	7.5k	ABULENCIA	06A CDF	0	$1900 p \bar{p} \rightarrow D^{*+} \pi^- X$
2425 ±3	235	⁶ ABREU	98M DLPH	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M253M;LINKAGE=B

NODE=M253M;LINKAGE=AR

NODE=M253M;LINKAGE=BA

NODE=M253M;LINKAGE=AB

NODE=M253M;LINKAGE=CH

NODE=M253M;LINKAGE=K

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

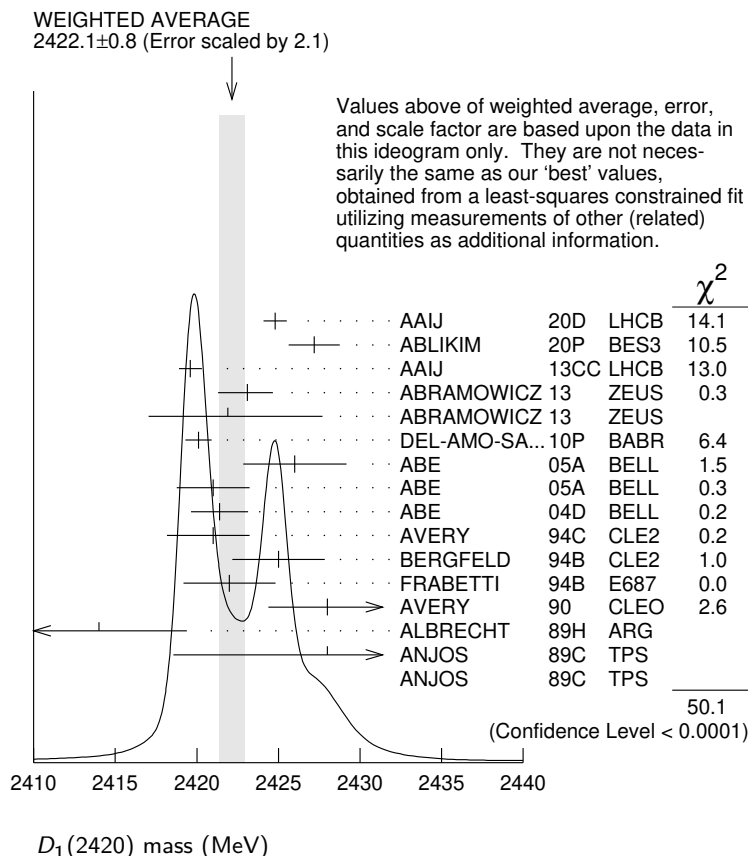
² From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

³ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.

⁴ Fit includes the contribution from $D_1^*(2430)^0$.

⁵ Calculated using the mass difference $m(D_1^0) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of 0.9 MeV.

⁶ No systematic error given.



$D_1(2420)$ mass (MeV)

$$m_{D_1(2420)^0} - m_{D^{*+}}$$

NODE=M253DM

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M253DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
411.8±0.6 OUR FIT	Error includes scale factor of 1.7. [411.8 ± 0.6 MeV OUR 2023 FIT Scale factor = 1.7]			
411.5±0.8 OUR AVERAGE				
410.2±2.1±0.9	3.1k	CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA 06A	CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$

NODE=M253DM

NEW

$$m_{D_1(2420)^\pm} - m_{D_1(2420)^0}$$

NODE=M253DMC

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4⁺²₋₃±3	BERGFELD 94B	CLE2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M253DMC

$D_1(2420)$ WIDTH

NODE=M253W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
31.3± 1.9 OUR AVERAGE	Error includes scale factor of 2.8. See the ideogram below.				
33.6± 0.3± 2.7	79k	¹ AAIJ	20D LHCb	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
23.2± 2.3± 2.3	4207	ABLIKIM	20P BES3	+	$e^+ e^- \rightarrow D^{*+} D^- \pi^+ \pi^-$
35.2± 0.4± 0.9	210k	AAIJ	13CC LHCb	0	$p p \rightarrow D^{*+} \pi^- X$
38.8± 5.0 ⁺ _{-1.9}	2.7k	² ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
31.4± 0.5± 1.3	103k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
20.0± 1.7± 1.3	7.5k	ABULENCIA	06A CDF	0	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$
24 ± 7 ± 8	151	ABE	05A BELL	0	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
21 ± 5 ± 8	124	ABE	05A BELL	+	$\bar{B}^0 \rightarrow D^+ \pi^+ \pi^- \pi^-$
23.7± 2.7± 4.0		³ ABE	04D BELL	0	$B^- \rightarrow D^{*+} \pi^- \pi^-$
20 ⁺ ₋₆ ± 3	286	AVERY	94C CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M253W

OCCUR=2

OCCUR=2

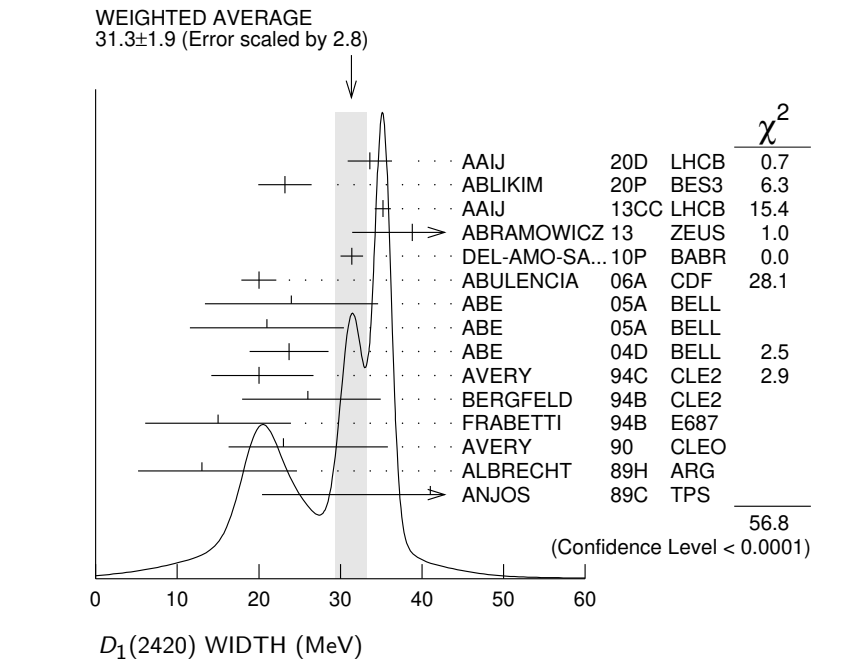
26	$\begin{smallmatrix} +8 \\ -7 \end{smallmatrix}$	± 4	146	BERGFELD	94B	CLE2	+	$e^+e^- \rightarrow D^{*0}\pi^+X$
15	± 8	± 4	51	FRABETTI	94B	E687	0	$\gamma Be \rightarrow D^{*+}\pi^-X$
23	$\begin{smallmatrix} +8 \\ -6 \end{smallmatrix}$	$\begin{smallmatrix} +10 \\ -3 \end{smallmatrix}$	279	AVERY	90	CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
13	± 6	$\begin{smallmatrix} +10 \\ -5 \end{smallmatrix}$	171	ALBRECHT	89H	ARG	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
41	± 19	± 8	190	ANJOS	89C	TPS	+	$\gamma N \rightarrow D^0\pi^+X^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •								
53.2	± 7.2	$\begin{smallmatrix} +3.3 \\ -4.9 \end{smallmatrix}$	3.1k	CHEKANOV	09	ZEUS	0	$e^\pm p \rightarrow D^{*+}\pi^-X$
58	± 14	± 10	171	ANJOS	89C	TPS	0	$\gamma N \rightarrow D^{*+}\pi^-X$

OCCUR=2

OCCUR=2

- ¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+}\pi^-\pi^-$ decay.
² From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .
³ Fit includes the contribution from $D_1^*(2430)^0$.

NODE=M253W;LINKAGE=B
NODE=M253W;LINKAGE=AR
NODE=M253W;LINKAGE=AB



D₁(2420) DECAY MODES

NODE=M253215;NODE=M253
NODE=M253

$\bar{D}_1(2420)$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*}(2007)^0\pi$	seen
Γ_2 $D\pi^+\pi^-$	
Γ_3 $D\rho^0$	
Γ_4 $Df_0(500)$	
Γ_5 $D_0^*(2300)^0\pi$	
Γ_6 $D^0\pi$	
Γ_7 $D^*\pi^+\pi^-$	

DESIG=1
DESIG=3
DESIG=4
DESIG=5
DESIG=6
DESIG=2
DESIG=7

D₁(2420) BRANCHING RATIOS

NODE=M253220

$\Gamma(D^{*}(2007)^0\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
seen	ACKERSTAFF	97W	OPAL	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
seen	AVERY	90	CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
seen	ALBRECHT	89H	ARG	0	$e^+e^- \rightarrow D^*\pi^-X$
seen	ANJOS	89C	TPS	0	$\gamma N \rightarrow D^{*+}\pi^-X$
seen	ANJOS	89C	TPS	+	$\gamma N \rightarrow D^0\pi^+X^0$

NODE=M253R01
NODE=M253R01
OCCUR=2

$\Gamma(D^0\pi)/\Gamma(D^*(2007)^0\pi)$ Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.18	90	BERGFELD	94B	CLE2	+	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.24	90	AVERY	90	CLEO	0	$e^+e^- \rightarrow D^+\pi^-X$

NODE=M253R02
 NODE=M253R02
 OCCUR=2

 $D_1(2420)$ POLARIZATION AMPLITUDE A_{D_1}

NODE=M253PAH

A polarization amplitude A_{D_1} is a parameter that depends on the initial polarization of the D_1 and is sensitive to a possible S -wave contribution to its decay. For D_1 decays the helicity angle, θ_h , distribution varies like $1 + A_{D_1} \cos^2 \theta_h$, where θ_h is the angle in the D^* rest frame between the two pions emitted by the $D_1 \rightarrow D^*\pi$ and the $D^* \rightarrow D\pi$.

NODE=M253PAH

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
5.73±0.25 OUR AVERAGE						
7.8 $\begin{smallmatrix} +6.7 \\ -2.7 \end{smallmatrix}$ $\begin{smallmatrix} +4.6 \\ -1.8 \end{smallmatrix}$	2.7k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$	
5.72±0.25	103k	DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$	
5.9 $\begin{smallmatrix} +3.0 \\ -1.7 \end{smallmatrix}$ $\begin{smallmatrix} +2.4 \\ -1.0 \end{smallmatrix}$		CHEKANOV 09	ZEUS	0	$e^\pm p \rightarrow D^{*+} \pi^- X$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
3.30±0.48	210k	² AAIJ	13CC	LHCB	0	$pp \rightarrow D^{*+} \pi^- X$
3.8 ±0.6 ±0.8		³ AUBERT	09Y	BABR	0	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
3.8 ±0.6 ±0.8		³ AUBERT	09Y	BABR	+	$B^0 \rightarrow D_1^- \ell^+ \nu_\ell$
2.74 $\begin{smallmatrix} +1.40 \\ -0.93 \end{smallmatrix}$		⁴ AVERY	94C	CLE2	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$

NODE=M253PAH

¹ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 . A pure D -wave not excluded although some $\bar{S}$ -wave mixing possible.

NODE=M253PAH;LINKAGE=AR

² Systematic uncertainty not estimated. Resonance parameters fixed.

NODE=M253PAH;LINKAGE=A

³ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths and helicity angle distributions for charged and neutral D_1 mesons.

NODE=M253PAH;LINKAGE=AU

⁴ Systematic uncertainties not estimated.

NODE=M253PAH;LINKAGE=AV

 $D_1(2420)$ REFERENCES

NODE=M253

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	20P	PL B804 135395	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABRAMOWICZ 13	NP	B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
DEL-AMO-SA... 10P	PR	D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABULENCIA	06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)
ABE	05A	PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)
BERGFELD	94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

REFID=60253
 REFID=60395
 REFID=55581
 REFID=54743
 REFID=53534
 REFID=52929
 REFID=52733
 REFID=51054
 REFID=50755
 REFID=50011
 REFID=46315
 REFID=45788
 REFID=44096
 REFID=44099
 REFID=43687
 REFID=41013
 REFID=41001
 REFID=40737

$D_1(2430)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

$J^P = 1^+$ determined by AAIJ 20D.

NODE=M180

NODE=M180

NODE=M180M

NODE=M180M

NODE=M180M;LINKAGE=A
NODE=M180M;LINKAGE=AU

NODE=M180W

NODE=M180W

NODE=M180W;LINKAGE=A
NODE=M180W;LINKAGE=AU

NODE=M180215;NODE=M180

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M180

REFID=60253
REFID=51140
REFID=50011

$D_1(2430)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2412± 9 OUR AVERAGE				
2411± 3± 9	79k	¹ AAIJ	20D LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2427±26±25		ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2477±28		² AUBERT	06L BABR	$\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.				
² Systematic errors not estimated.				

$D_1(2430)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
314± 29 OUR AVERAGE				
309± 9±28	79k	¹ AAIJ	20D LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
384 ⁺¹⁰⁷ ₋₇₅ ±74		ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
266± 97		² AUBERT	06L BABR	$\bar{B}^0 \rightarrow D^{*+} \omega \pi^-$
¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.				
² Systematic errors not estimated.				

$D_1(2430)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^*(2010)^+ \pi^-$	seen

$D_1(2430)^0$ REFERENCES

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AUBERT	06L	PR D74 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)

$D_2^*(2460)$

$$I(J^P) = \frac{1}{2}(2^+)$$

NODE=M254

 $D_2^*(2460)$ MASS

NODE=M254M

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
2461.1±0.8 OUR FIT	Error includes scale factor of 6.3. [2461.1 ^{+0.7} _{-0.8} MeV OUR 2023 FIT Scale factor = 6.2]				
2461.1±0.7 OUR AVERAGE	Error includes scale factor of 5.2. See the ideogram below.				
2463.7±0.4±0.7	28k	¹ AAIJ	16AH LHCb	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.0±1.4±0.5	2k	² AAIJ	15V LHCb	0	$B^- \rightarrow D^+ K^- \pi^-$
2465.6±1.8±1.3		³ AAIJ	15X LHCb	+	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2468.6±0.6±0.3		⁴ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2460.4±0.4±1.2	82k	AAIJ	13CC LHCb	0	$pp \rightarrow D^{*+} \pi^- X$
2460.4±0.1±0.1	675k	AAIJ	13CC LHCb	0	$pp \rightarrow D^+ \pi^- X$
2463.1±0.2±0.6	342k	AAIJ	13CC LHCb	+	$pp \rightarrow D^0 \pi^+ X$
2462.5±2.4 ^{+1.3} _{-1.1}	2.3k	⁵ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2460.6±4.4 ^{+3.6} _{-0.8}	1371	⁶ ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2462.2±0.1±0.8	243k	DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2465.4±0.2±1.1	111k	⁷ DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2460.4±1.2±2.2	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	+	$e^+ e^- \rightarrow \text{hadrons}$
2461.6±2.1±3.3		⁸ ABE	04D BELL	0	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5±1.1±1.9	5.8k	⁸ LINK	04A FOCS	0	γA
2465 ±3 ±3	486	AVERY	94C CLE2	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2463 ±3 ±3	310	BERGFELD	94B CLE2	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	128	FRABETTI	94B E687	0	$\gamma Be \rightarrow D^+ \pi^- X$
2453 ±3 ±2	185	FRABETTI	94B E687	+	$\gamma Be \rightarrow D^0 \pi^+ X$
2461 ±3 ±1	440	AVERY	90 CLEO	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 ±3 ±5	337	ALBRECHT	89B ARG	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2469 ±4 ±6		ALBRECHT	89F ARG	+	$e^+ e^- \rightarrow D^0 \pi^+ X$
2459 ±3 ±2	153	ANJOS	89C TPS	0	$\gamma N \rightarrow D^+ \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2468.1±0.6±0.5		⁹ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2469.1±3.7 ^{+1.2} _{-1.3}	1.5k	¹⁰ CHEKANOV	09 ZEUS	0	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2463.3±0.6±0.8	20k	ABULENCIA	06A CDF	0	$1900 p\bar{p} \rightarrow D^+ \pi^- X$
2467.6±1.5±0.8	3.5k	¹¹ LINK	04A FOCS	+	γA
2461 ±6	126	¹² ABREU	98M DLPH	0	$e^+ e^-$
2466 ±7	1	ASRATYAN	95 BEBC	0	$53,40 \nu(\bar{\nu}) \rightarrow pX, dX$

NODE=M254M

NEW

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M254M;LINKAGE=B

NODE=M254M;LINKAGE=A

NODE=M254M;LINKAGE=CA

NODE=M254M;LINKAGE=BC

NODE=M254M;LINKAGE=AR

NODE=M254M;LINKAGE=AB

NODE=M254M;LINKAGE=DE

NODE=M254M;LINKAGE=LI

NODE=M254M;LINKAGE=CC

NODE=M254M;LINKAGE=CH

¹ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.

⁴ Modeling the $\pi^+ \pi^-$ S-wave with the Isobar formalism.

⁵ From the combined fit of the $M(D^+ \pi^-)$ and $M(D^{*+} \pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

⁶ From the fit of the $M(D^0 \pi^+)$ distribution. The widths of the D_1^+ and D_2^+ are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.

⁷ At a fixed width of 50.5 MeV.

⁸ Fit includes the contribution from $D_0^*(2400)^0$.

⁹ Modeling the $\pi^+ \pi^-$ S-wave with the K-matrix formalism.

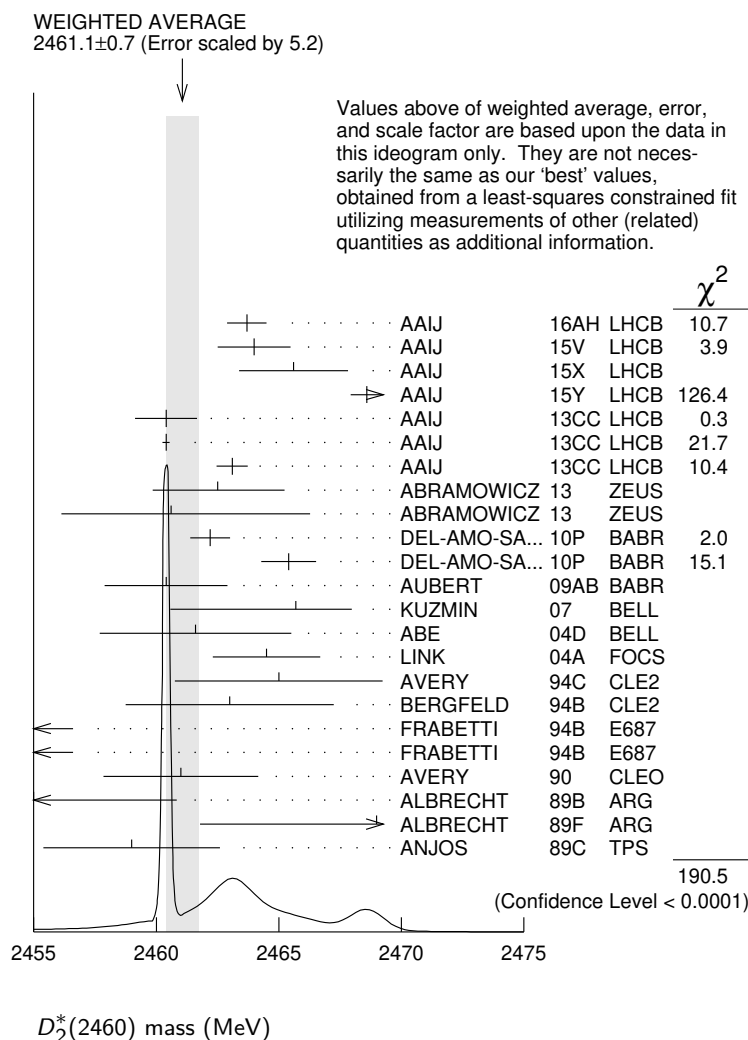
¹⁰ Calculated using the mass difference $m(D_2^{*0}) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV. The 0.17 MeV uncertainty of the PDG mass value should be added to the experimental uncertainty of $^{+1.2}_{-1.3}$ MeV.

¹¹ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm}) - (m_{D_2^*(2460)^0})$.

NODE=M254M;LINKAGE=LC

¹² No systematic error given.

NODE=M254M;LINKAGE=K



$$m_{D_2^*(2460)^0} - m_{D^+}$$

NODE=M254DM

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
591.5±0.8 OUR FIT	Error includes scale factor of 6.0.	[591.5 ^{+0.7} _{-0.8} MeV OUR 2023		
FIT Scale factor = 5.9]				
593.9±0.6±0.5	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$

NODE=M254DM

NEW

$$m_{D_2^*(2460)^0} - m_{D^{*+}}$$

NODE=M254DM2

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M254DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
450.9±0.8 OUR FIT	Error includes scale factor of 6.0.	[450.9 ^{+0.7} _{-0.8} MeV OUR 2023		
FIT Scale factor = 5.9]				
458.8±3.7^{+1.2}_{-1.3}	1.5k	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$

NODE=M254DM2

NEW

$$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$$

NODE=M254DMC

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2.4±1.7 OUR AVERAGE			
3.1±1.9±0.9	LINK	04A FOCS	γA
− 2 ±4 ±4	BERGFELD	94B CLE2	$e^+e^- \rightarrow \text{hadrons}$
0 ±4	FRABETTI	94B E687	$\gamma Be \rightarrow D\pi X$
14 ±5 ±8	ALBRECHT	89F ARG	$e^+e^- \rightarrow D^0\pi^+X$

NODE=M254DMC

$D_2^*(2460)$ WIDTH

NODE=M254W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
47.3± 0.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
47.0± 0.8± 1.0	28k	¹ AAIJ	16AH LHCb	0	$B^- \rightarrow D^+\pi^-\pi^-$
43.8± 2.9± 1.8	2k	² AAIJ	15V LHCb	0	$B^- \rightarrow D^+K^-\pi^-$
46.0± 3.4± 3.2		³ AAIJ	15X LHCb	+	$B^0 \rightarrow \bar{D}^0K^+\pi^-$
47.3± 1.5± 0.7		⁴ AAIJ	15Y LHCb	+	$B^0 \rightarrow \bar{D}^0\pi^+\pi^-$
43.2± 1.2± 3.0	82k	AAIJ	13CC LHCb	0	$pp \rightarrow D^{*+}\pi^-X$
45.6± 0.4± 1.1	675k	AAIJ	13CC LHCb	0	$pp \rightarrow D^+\pi^-X$
48.6± 1.3± 1.9	342k	AAIJ	13CC LHCb	+	$pp \rightarrow D^0\pi^+X$
46.6± 8.1 ⁺ _− 5.9 _{3.8}	2.3k	⁵ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$
50.5± 0.6± 0.7	243k	DEL-AMO-SA..10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
41.8± 2.5± 2.9	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+\pi^-\pi^-$
49.7± 3.8± 6.4	2909	KUZMIN	07 BELL	+	$e^+e^- \rightarrow \text{hadrons}$
49.2± 2.3± 1.3	20k	ABULENCIA	06A CDF	0	$1900 p\bar{p} \rightarrow D^+\pi^-X$
45.6± 4.4± 6.7		⁶ ABE	04D BELL	0	$B^- \rightarrow D^+\pi^-\pi^-$
38.7± 5.3± 2.9	5.8k	⁶ LINK	04A FOCS	0	γA
34.1± 6.5± 4.2	3.5k	⁷ LINK	04A FOCS	+	γA
28 ⁺ _− 8 ₇ ± 6	486	AVERY	94C CLE2	0	$e^+e^- \rightarrow D^+\pi^-X$
27 ⁺ _− 11 ₈ ± 5	310	BERGFELD	94B CLE2	+	$e^+e^- \rightarrow D^0\pi^+X$
25 ±10 ± 5	128	FRABETTI	94B E687	0	$\gamma Be \rightarrow D^+\pi^-X$
23 ± 9 ± 5	185	FRABETTI	94B E687	+	$\gamma Be \rightarrow D^0\pi^+X$
20 ⁺ _− 9 ₁₂ ⁺ _− 9 ₁₀	440	AVERY	90 CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$
15 ⁺ _− 13 ₁₀ ⁺ _− 5 ₁₀	337	ALBRECHT	89B ARG	0	$e^+e^- \rightarrow D^+\pi^-X$
20 ±10 ± 5	153	ANJOS	89C TPS	0	$\gamma N \rightarrow D^+\pi^-X$

NODE=M254W

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M254W;LINKAGE=D

NODE=M254W;LINKAGE=A

NODE=M254W;LINKAGE=AC

NODE=M254W;LINKAGE=B

NODE=M254W;LINKAGE=AR

NODE=M254W;LINKAGE=LI

NODE=M254W;LINKAGE=LC

NODE=M254W;LINKAGE=C

• • • We do not use the following data for averages, fits, limits, etc. • • •

46.0± 1.4± 1.8 ⁸ AAIJ 15Y LHCb + $B^0 \rightarrow \bar{D}^0\pi^+\pi^-$

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

³ From the Dalitz plot analysis including various K^* and D^{**} mesons as well as broad structures in the $K\pi$ S-wave and the $D\pi$ S- and P-waves.

⁴ Modeling the $\pi^+\pi^-$ S-wave with the Isobar formalism.

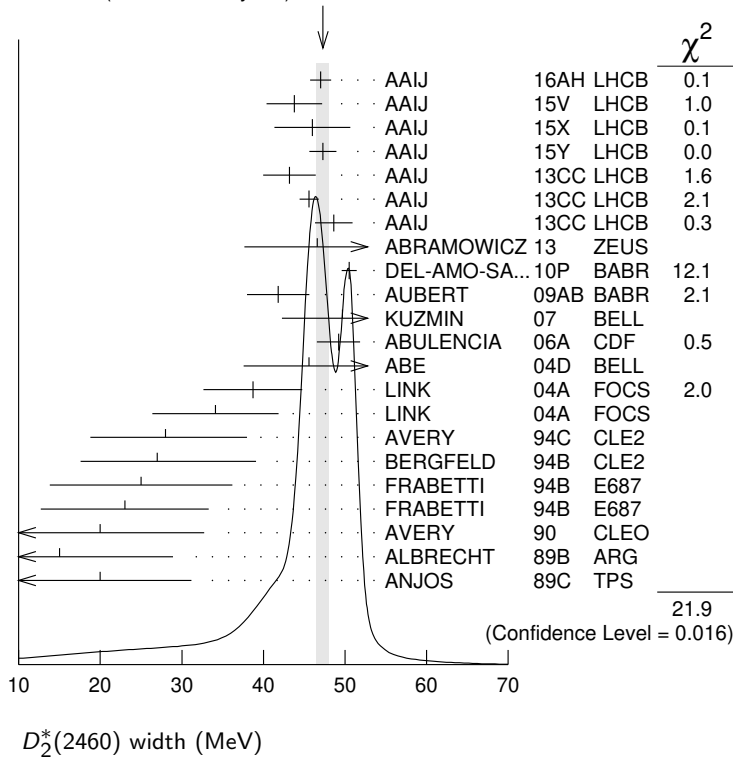
⁵ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .

⁶ Fit includes the contribution from $D_0^*(2400)^0$.

⁷ Fit includes the contribution from $D_0^*(2400)^\pm$.

⁸ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.

WEIGHTED AVERAGE
47.3±0.8 (Error scaled by 1.5)



$D_2^*(2460)$ DECAY MODES

NODE=M254215;NODE=M254

$\bar{D}_2^*(2460)$ modes are charge conjugates of modes below.

NODE=M254

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\pi^-$	seen
Γ_2 $D^*(2010)\pi^-$	seen
Γ_3 $D\pi^+\pi^-$	
Γ_4 $D^*\pi^+\pi^-$	

DESIG=1

DESIG=2

DESIG=3

DESIG=4

$D_2^*(2460)$ BRANCHING RATIOS

NODE=M254220

$\Gamma(D\pi^-)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	3.4k	AUBERT	09AB BABR	0	$B^- \rightarrow D^+\pi^-\pi^-$	
seen	337	ALBRECHT	89B ARG	0	$e^+e^- \rightarrow D^+\pi^-X$	
seen		ALBRECHT	89F ARG	+	$e^+e^- \rightarrow D^0\pi^+X$	
seen		ANJOS	89C TPS	0	$\gamma N \rightarrow D^+\pi^-X$	

NODE=M254R1

NODE=M254R1

$\Gamma(D^*(2010)\pi^-)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
seen		ACKERSTAFF	97W OPAL	0	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		AVERY	90 CLEO	0	$e^+e^- \rightarrow D^{*+}\pi^-X$	
seen		ALBRECHT	89H ARG	0	$e^+e^- \rightarrow D^*\pi^-X$	

NODE=M254R2

NODE=M254R2

$\Gamma(D\pi^-)/\Gamma(D^*(2010)\pi^-)$						Γ_1/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
1.52±0.14 OUR AVERAGE						
1.4 ±0.3 ±0.3	2.3k	1 ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$	
1.1 ±0.4 ±0.3 -0.2	1371	2 ABRAMOWICZ13	ZEUS	+	$e^\pm p \rightarrow D^{(*)0}\pi^+X$	
1.47±0.03±0.16	379k	DEL-AMO-SA...10P	BABR	0	$e^+e^- \rightarrow D^{(*)+}\pi^-X$	
2.8 ±0.8 ±0.5 -0.6	1.5k	CHEKANOV	09 ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$	
2.2 ±0.7 ±0.6		AVERY	94C CLE2	0	$e^+e^- \rightarrow D^{*+}\pi^-X$	

NODE=M254R3

NODE=M254R3

OCCUR=2

1.9 ±1.1 ±0.3	BERGFELD	94B	CLE2	+	$e^+e^- \rightarrow \text{hadrons}$
2.3 ±0.8	AVERY	90	CLEO	0	e^+e^-
3.0 ±1.1 ±1.5	ALBRECHT	89H	ARG	0	$e^+e^- \rightarrow D^*\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					

1.9 ±0.5	ABE	04D	BELL	0	$B^- \rightarrow D^{(*)+}\pi^-\pi^-$
¹ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions. and A_{D_2} fixed to the theoretical prediction of -1 .					
² From the fit of the $M(D^0\pi^+)$ distribution. The widths of the D_1^+ and D_2^{*+} are fixed to 25 MeV and 37 MeV, and A_{D_1} and A_{D_2} are fixed to the theoretical predictions of 3 and -1 , respectively.					

$\Gamma(D\pi^-)/[\Gamma(D\pi^-) + \Gamma(D^*(2010)\pi^-)]$					$\Gamma_1/(\Gamma_1+\Gamma_2)$
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.62 ±0.03 ±0.02	8414	¹ AUBERT	09Y	BABR	0 $B^+ \rightarrow D_2^{*0}\ell^+\nu_\ell$
0.62 ±0.03 ±0.02	3361	¹ AUBERT	09Y	BABR	0 $\bar{B}^0 \rightarrow D_2^{*+}\ell^-\nu_\ell$
¹ Assuming $\Gamma(\Upsilon(4S) \rightarrow B^+B^-) / \Gamma(\Upsilon(4S) \rightarrow B^0\bar{B}^0) = 1.065 \pm 0.026$ and equal partial widths for charged and neutral D_2^* mesons.					

$D_2^*(2460)$ POLARIZATION AMPLITUDE A_{D_2}

A polarization amplitude A_{D_2} is a parameter that depends on the initial polarization of the D_2 . For D_2 decays the helicity angle, θ_H , distribution varies like $1 + A_{D_2} \cos^2(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_2 \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$.

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
-1.16 ± 0.35	2.3k	¹ ABRAMOWICZ13	ZEUS	0	$e^\pm p \rightarrow D^{(*)+}\pi^-X$
consistent with -1	243k	DEL-AMO-SA...10P	BABR	0	$e^+e^- \rightarrow D^+\pi^-X$
$-0.74^{+0.49}_{-0.38}$		² AVERY	94C	CLE2	0 $e^+e^- \rightarrow D^{*+}\pi^-X$
¹ From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions.					
² Systematic uncertainties not estimated.					

$D_2^*(2460)$ REFERENCES

AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57518
AAIJ	15V	PR D91 092002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56575
Also		PR D93 119901 (errat.)	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57289
AAIJ	15X	PR D92 012012	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56588
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56609
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55581
ABRAMOWICZ 13	NP	B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)	REFID=54743
DEL-AMO-SA...10P	PR	D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53534
AUBERT	09AB	PR D79 112004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52941
AUBERT	09Y	PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52929
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
KUZMIN	07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)	REFID=51854
ABULENCIA	06A	PR D73 051104	A. Abulencia <i>et al.</i>	(CDF Collab.)	REFID=51054
ABE	04D	PR D69 112002	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50011
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)	REFID=49775
ABREU	98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46315
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=44439
AVERY	94C	PL B331 236	P. Avery <i>et al.</i>	(CLEO Collab.)	REFID=44096
BERGFELD	94B	PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)	REFID=44099
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=40736
ALBRECHT	89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40931
ALBRECHT	89H	PL B232 398	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP	REFID=41001
ANJOS	89C	PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)	REFID=40737

OCCUR=2

NODE=M254R3;LINKAGE=AR

NODE=M254R3;LINKAGE=AB

NODE=M254R01
NODE=M254R01

OCCUR=2

NODE=M254R01;LINKAGE=AU

NODE=M254PAM

NODE=M254PAM

NODE=M254PAM

NODE=M254PAM;LINKAGE=AB
NODE=M254PAM;LINKAGE=AV

NODE=M254

NODE=M198

$D_0(2550)^0$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE
 $J^P = 0^-$ determined by AAIJ 20D.

NODE=M198

NODE=M198M

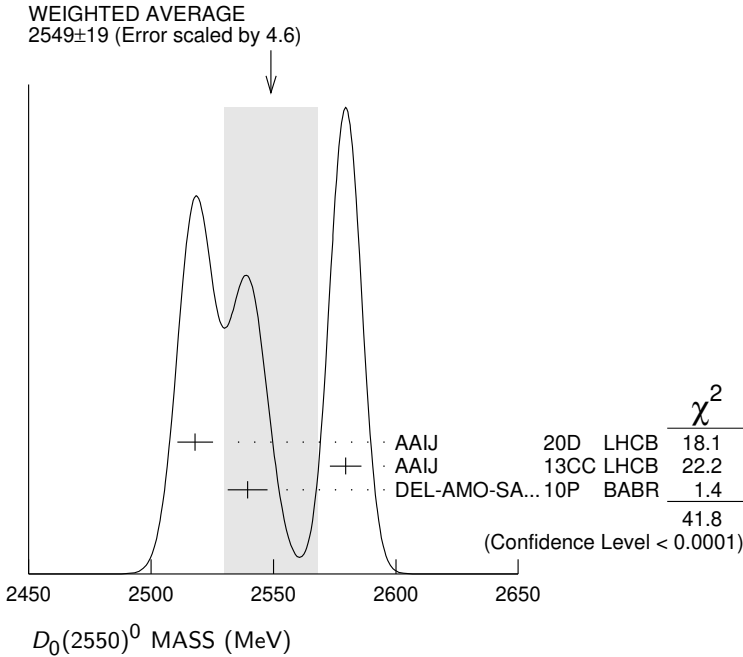
NODE=M198M

NODE=M198M;LINKAGE=A

$D_0(2550)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2549 ±19 OUR AVERAGE		Error includes scale factor of 4.6. See the ideogram below.		
2518 ± 2 ±7	79k	¹ AAIJ	20D LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2579.5± 3.4±5.5	60k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
2539.4± 4.5±6.8	34k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.



$D_0(2550)^0$ WIDTH

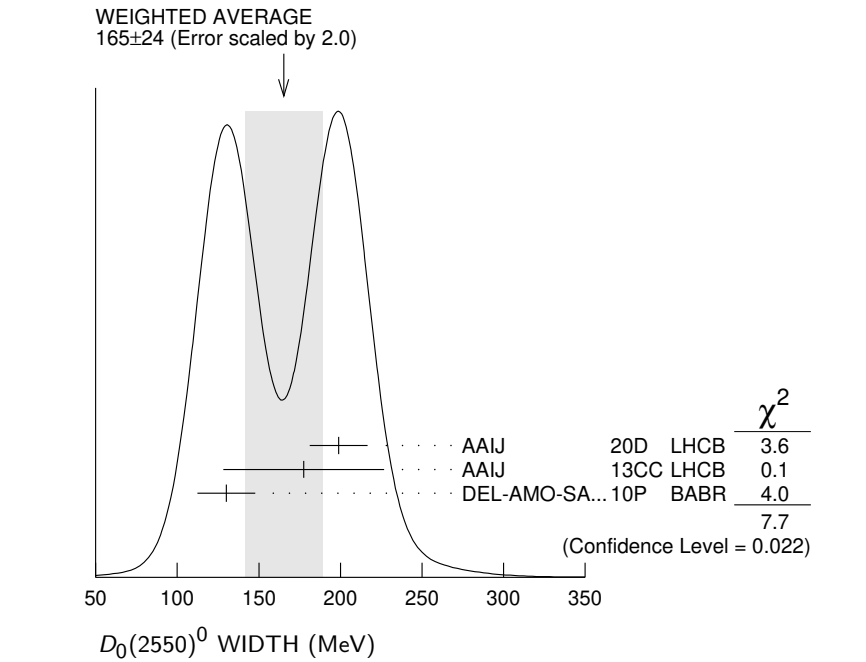
NODE=M198W

NODE=M198W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
165 ±24 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
199 ± 5 ±17	79k	¹ AAIJ	20D LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
177.5±17.8±46.0	60k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
130 ±12 ±13	34k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M198W;LINKAGE=A



$D_0(2550)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+}\pi^-$	seen

$D_0(2550)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$ decays.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.2 ± 1.3	60k	¹ AAIJ	13CC LHCb	$pp \rightarrow D^{*+}\pi^- X$
¹ Systematic uncertainty not estimated.				

$D_0(2550)^0$ REFERENCES

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...	10P	PR D82 111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M198215;NODE=M198

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M198PAM

NODE=M198PAM

NODE=M198PAM

NODE=M198PAM;LINKAGE=A

NODE=M198

REFID=60253
REFID=55581
REFID=53534

NODE=M199

 $D_1^*(2600)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

OMITTED FROM SUMMARY TABLE

was $D_J^*(2600)$ $J^P = 1^-$ determined by AAIJ 20D.

NODE=M199

 $D_1^*(2600)^0$ MASS

NODE=M199M

NODE=M199M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
2627 ±10 OUR AVERAGE		Error includes scale factor of 4.4. See the ideogram below.			
2641.9 ± 1.8 ± 4.5	79k	¹ AAIJ	20D	LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2681.1 ± 5.6 ± 14.0	28k	² AAIJ	16AH	LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
2649.2 ± 3.5 ± 3.5	51k	AAIJ	13CC	LHCB	$pp \rightarrow D^{*+} \pi^- X$
2608.7 ± 2.4 ± 2.5	26k	DEL-AMO-SA...10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2621.3 ± 3.7 ± 4.2	13k	³ DEL-AMO-SA...10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

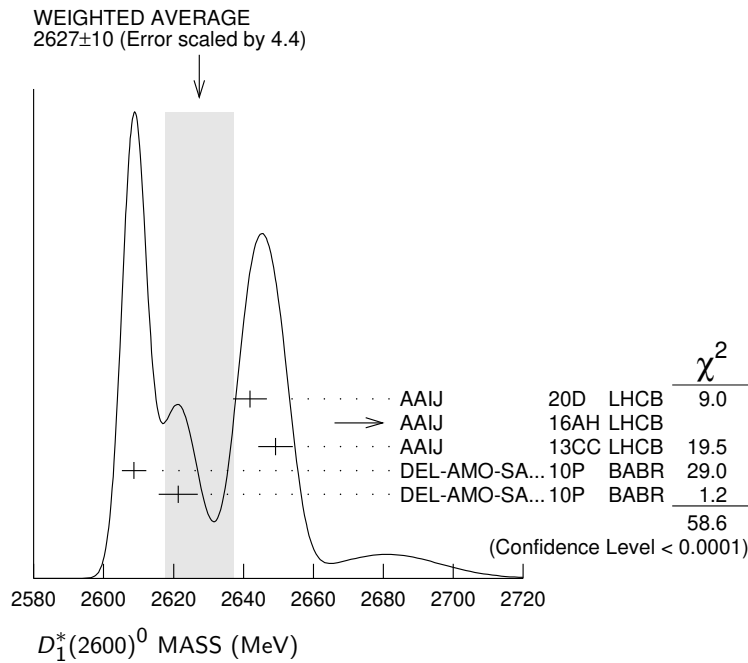
OCCUR=2

NODE=M199M;LINKAGE=B

NODE=M199M;LINKAGE=A

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.³ At a fixed width of 93 MeV.

NODE=M199M;LINKAGE=DE

 **$D_1^*(2600)^0$ WIDTH**

NODE=M199W

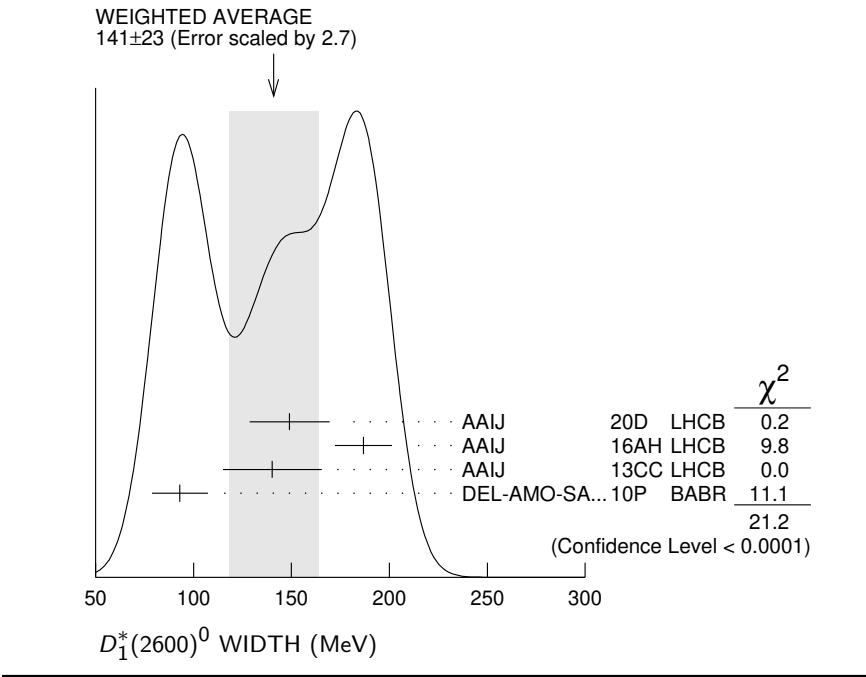
NODE=M199W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	
141 ±23 OUR AVERAGE	Error	includes scale factor of 2.7. See the ideogram below.			
149 ± 4 ±20	79k	¹ AAIJ	20D	LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
186.7 ± 8.5 ±11.9	28k	² AAIJ	16AH	LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
140.2 ±17.1 ±18.6	51k	AAIJ	13CC	LHCB	$pp \rightarrow D^{*+} \pi^- X$
93 ± 6 ±13	26k	DEL-AMO-SA..10P	BABR		$e^+ e^- \rightarrow D^+ \pi^- X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

NODE=M199W;LINKAGE=B

NODE=M199W;LINKAGE=A



$D_1^*(2600)^0$ DECAY MODES

Mode		Fraction (Γ_i/Γ)
Γ_1	$D\pi$	seen
Γ_2	$D^+\pi^-$	seen
Γ_3	$D^0\pi^\pm$	seen
Γ_4	$D^*\pi$	seen
Γ_5	$D^{*+}\pi^-$	seen

NODE=M199215;NODE=M199

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

$D_1^*(2600)^0$ BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}\pi^-)$					Γ_2/Γ_5
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.32±0.02±0.09	76k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$	

NODE=M199220

NODE=M199R01
NODE=M199R01

$D_1^*(2600)^0$ REFERENCES

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA...10P	PR D82	111101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

NODE=M199

REFID=60253
REFID=57518
REFID=55581
REFID=53534

$D^*(2640)^\pm$

$$I(J^P) = \frac{1}{2}(?^?)$$

OMITTED FROM SUMMARY TABLE
Seen in Z decays by ABREU 98M. Not seen by ABBIENDI 01N and
CHEKANOV 09. Needs confirmation.

NODE=M158

NODE=M158

$D^*(2640)^\pm$ MASS

NODE=M158M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2637 ± 2 ± 6	66 ± 14	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158M

$D^*(2640)^\pm$ WIDTH

NODE=M158W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

NODE=M158W

$D^*(2640)^+$ DECAY MODES

NODE=M158215;NODE=M158

$D^*(2640)^-$ modes are charge conjugates of modes below.

NODE=M158

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^*(2010)^+\pi^+\pi^-$	seen

DESIG=1;OUR EST;→ UNCHECKED ←

$D^*(2640)^\pm$ REFERENCES

NODE=M158

CHEKANOV 09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)
ABBIENDI 01N	EPJ C20 445	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
ABREU 98M	PL B426 231	P. Abreu <i>et al.</i>	(DELPHI Collab.)

REFID=52733
REFID=48296
REFID=46315

NODE=M228

$D_2(2740)^0$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE
was $D(2740)^0$
 $J^P = 2^-$ determined by (AAIJ 20D).

NODE=M228

$D_2(2740)^0$ MASS

NODE=M228M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2747 ± 6 OUR AVERAGE				
2751 ± 3 ± 7	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+}\pi^-\pi^-$
2737.0 ± 3.5 ± 11.2	7.7k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+}\pi^-X$

NODE=M228M

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+}\pi^-\pi^-$ decay.

NODE=M228M;LINKAGE=A

$D_2(2740)^0$ WIDTH

NODE=M228W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
88 ± 19 OUR AVERAGE				
102 ± 6 ± 26	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+}\pi^-\pi^-$
73.2 ± 13.4 ± 25.0	7.7k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+}\pi^-X$

NODE=M228W

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+}\pi^-\pi^-$ decay.

NODE=M228W;LINKAGE=A

$D_2(2740)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^{*+} \pi^-$	seen

 $D_2(2740)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.1 ± 2.2 $7.7k$ ^{1} AAIJ 13CC LHCb $pp \rightarrow D^{*+} \pi^- X$

¹ Systematic uncertainty not estimated.

 $D_2(2740)^0$ REFERENCES

AAIJ	20D PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)

$D_3^*(2750)$

$$I(J^P) = \frac{1}{2}(3^-)$$

J^P determined by AAIJ 15Y from the Dalitz plot analysis of $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$ decays.

 $D_3^*(2750)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

2763.1 ± 3.2 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

2753 ± 4 ± 6	79k	¹ AAIJ	20D LHCb		$B^- \rightarrow D^{*+} \pi^- \pi^-$
2775.5 ± 4.5 ± 6.5	28k	² AAIJ	16AH LHCb		$B^- \rightarrow D^+ \pi^- \pi^-$
2798 ± 7 ± 7		³ AAIJ	15Y LHCb		$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2761.1 ± 5.1 ± 6.5	14k	AAIJ	13CC LHCb	0	$pp \rightarrow D^{*+} \pi^- X$
2760.1 ± 1.1 ± 3.7	56k	AAIJ	13CC LHCb	0	$pp \rightarrow D^+ \pi^- X$
2771.7 ± 1.7 ± 3.8	20k	AAIJ	13CC LHCb	+	$pp \rightarrow D^0 \pi^+ X$
2752.4 ± 1.7 ± 2.7	23.5k	⁴ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2763.3 ± 2.3 ± 2.3	11.3k	⁴ DEL-AMO-SA..10P	BABR	0	$e^+ e^- \rightarrow D^+ \pi^- X$
2769.7 ± 3.8 ± 1.5	5.7k	^{4,5} DEL-AMO-SA..10P	BABR	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2802 \pm 11 \pm 10$ ^{6} AAIJ 15Y LHCb $B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

³ Modeling the $\pi^+ \pi^-$ S-wave with the Isobar formalism.

⁴ The states observed in the $D^* \pi$ and $D \pi$ final states are not necessarily the same.

⁵ At a fixed width of 60.9 MeV.

⁶ Modeling the $\pi^+ \pi^-$ S-wave with the K-matrix formalism.

NODE=M228215;NODE=M228

DESIG=1;OUR EVAL;→ UNCHECKED ←

NODE=M228PAM

NODE=M228PAM

NODE=M228PAM

NODE=M228PAM;LINKAGE=A

NODE=M228

REFID=60253
REFID=55581

NODE=M203

NODE=M203

NODE=M203M

NODE=M203M

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M203M;LINKAGE=D

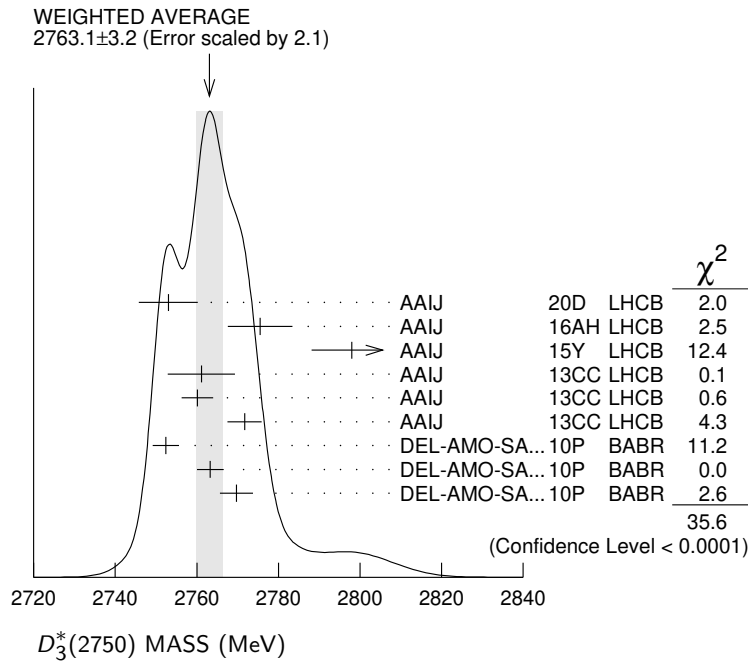
NODE=M203M;LINKAGE=C

NODE=M203M;LINKAGE=A

NODE=M203M;LINKAGE=DE

NODE=M203M;LINKAGE=DA

NODE=M203M;LINKAGE=B



$D_3^*(2750)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
66 $\pm$ 5 OUR AVERAGE					
66 $\pm$ 10 $\pm$ 14	79k	¹ AAIJ	20D	LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
95.3 $\pm$ 9.6 $\pm$ 34.0	28k	² AAIJ	16AH	LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
105 $\pm$ 18 $\pm$ 24		³ AAIJ	15Y	LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
74.4 $\pm$ 3.4 $\pm$ 37.0	14k	AAIJ	13CC	LHCB 0	$pp \rightarrow D^{*+} \pi^- X$
74.4 $\pm$ 3.4 $\pm$ 19.1	56k	AAIJ	13CC	LHCB 0	$pp \rightarrow D^+ \pi^- X$
66.7 $\pm$ 6.6 $\pm$ 10.5	20k	AAIJ	13CC	LHCB +	$pp \rightarrow D^0 \pi^+ X$
71 $\pm$ 6 $\pm$ 11	23.5k	⁴ DEL-AMO-SA...10P	BABR		$e^+ e^- \rightarrow D^{*+} \pi^- X$
60.9 $\pm$ 5.1 $\pm$ 3.6	11.3k	⁴ DEL-AMO-SA...10P	BABR		$e^+ e^- \rightarrow D^+ \pi^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

154 $\pm$ 27 $\pm$ 16	⁵ AAIJ	15Y	LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

² From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

³ Modeling the $\pi^+ \pi^-$ S-wave with the Isobar formalism.

⁴ The states observed in the $D^* \pi$ and $D \pi$ final states are not necessarily the same.

⁵ Modeling the $\pi^+ \pi^-$ S-wave with the K-matrix formalism.

NODE=M203W

NODE=M203W

OCCUR=2

OCCUR=4

OCCUR=2

OCCUR=2

NODE=M203W;LINKAGE=D

NODE=M203W;LINKAGE=C

NODE=M203W;LINKAGE=A

NODE=M203W;LINKAGE=DE

NODE=M203W;LINKAGE=B

$D_3^*(2750)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D \pi$	seen
Γ_2 $D^+ \pi^-$	seen
Γ_3 $D^0 \pi^\pm$	seen
Γ_4 $D^* \pi$	seen
Γ_5 $D^{*+} \pi^-$	seen

NODE=M203215;NODE=M203

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4;OUR EVAL;→ UNCHECKED ←

DESIG=5;OUR EVAL;→ UNCHECKED ←

$D_3^*(2750)$ BRANCHING RATIOS

$\Gamma(D^+ \pi^-)/\Gamma(D^{*+} \pi^-)$					Γ_2/Γ_5
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.42 $\pm$ 0.05 $\pm$ 0.11	34.8k	¹ DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{(*)+} \pi^- X$	

NODE=M203220

NODE=M203R01

NODE=M203R01

¹ The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D_3^*(2750)$ POLARIZATION AMPLITUDE A_D

A polarization amplitude A_D is a parameter that depends on the initial polarization of the $D_3^*(2750)$. For $D_3^*(2750)$ decays the helicity angle, θ_H , distribution varies like $1 + A_D \cos(\theta_H)$, where θ_H is the angle in the D^* rest frame between the two pions emitted by the $D_3^*(2750) \rightarrow D^*\pi$ and $D^* \rightarrow D\pi$.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

-0.33 ± 0.28	23.5k	¹ DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^- X$

¹ Systematic uncertainties not estimated. The states observed in the $D^*\pi$ and $D\pi$ final states are not necessarily the same.

$D_3^*(2750)$ REFERENCES

AAIJ	20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	16AH	PR D94 072001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15Y	PR D92 032002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	13CC	JHEP 1309 145	R. Aaij <i>et al.</i>	(LHCb Collab.)
DEL-AMO-SA... 10P	PR D82 111101		P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)

$D_1^*(2760)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

OMITTED FROM SUMMARY TABLE

J^P determined by AAIJ 15V from the Dalitz plot analysis of $B^- \rightarrow D^+ K^- \pi^-$ decays.

$D_1^*(2760)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

$2781 \pm 18 \pm 13$	2k	¹ AAIJ	15V LHCb	$B^- \rightarrow D^+ K^- \pi^-$

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

$D_1^*(2760)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

180 ± 40 OUR AVERAGE	[177 $\pm$ 40 MeV OUR 2023 AVERAGE]			

$177 \pm 32 \pm 21$	2k	¹ AAIJ	15V LHCb	$B^- \rightarrow D^+ K^- \pi^-$

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

$D_1^*(2760)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+\pi^-$	seen

$D_1^*(2760)^0$ BRANCHING RATIOS

$\Gamma(D^+\pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	¹ AAIJ	15V LHCb	$B^- \rightarrow D^+ K^- \pi^-$	

¹ From the amplitude analysis in the model describing the $D^+\pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, nonresonant spin-0 and spin-1 components as well as the $D_0^*(2400)^0$, $D_2^*(2460)^0$ and $D_1^*(2760)^0$ resonances.

NODE=M203R01;LINKAGE=DE

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM

NODE=M203PAM;LINKAGE=DE

NODE=M203

REFID=60253
REFID=57518
REFID=56609
REFID=55581
REFID=53534

NODE=M249

NODE=M249

NODE=M249M

NODE=M249M

NODE=M249M;LINKAGE=A

NODE=M249W

NODE=M249W
NEW

NODE=M249W;LINKAGE=A

NODE=M249215;NODE=M249

DESIG=1

NODE=M249225

NODE=M249R01
NODE=M249R01
OCCUR=2

NODE=M249R01;LINKAGE=A

$D_1^*(2760)^0$ REFERENCES

AAIJ 15V PR D91 092002 R. Aaij *et al.* (LHCb Collab.) JP
Also PR D93 119901 (errat.) R. Aaij *et al.* (LHCb Collab.)

NODE=M249

REFID=56575
REFID=57289

NODE=M229

 $D(3000)^0$

$$I(J^P) = \frac{1}{2}(?)$$

OMITTED FROM SUMMARY TABLE

Both natural- and unnatural-parity components observed depending on the decay mode (AAIJ 13CC).

NODE=M229

 $D(3000)^0$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3210 ± 60 OUR AVERAGE		[3214 ± 60 MeV OUR 2023 AVERAGE]		
3214 ± 29 ± 49	28k	¹ AAIJ	16AH LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2971.8 ± 8.7	9.5k	^{2,3} AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
3008.1 ± 4.0	17.6k	^{2,4} AAIJ	13CC LHCb	$pp \rightarrow D^+ \pi^- X$

NODE=M229M

NODE=M229M

NEW

OCCUR=2

NODE=M229M;LINKAGE=D

¹ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

² Systematic uncertainty not estimated.

³ Unnatural parity preferred.

⁴ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0 \pi^+$ final state.

NODE=M229M;LINKAGE=A

NODE=M229M;LINKAGE=B

NODE=M229M;LINKAGE=C

 $D(3000)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
190 ± 80 OUR AVERAGE		[186 ± 80 MeV OUR 2023 AVERAGE]		
186 ± 38 ± 72	28k	⁵ AAIJ	16AH LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
188.1 ± 44.8	9.5k	^{6,7} AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
110.5 ± 11.5	17.6k	^{6,8} AAIJ	13CC LHCb	$pp \rightarrow D^+ \pi^- X$

NODE=M229W

NODE=M229W

NEW

OCCUR=2

NODE=M229W;LINKAGE=D

⁵ From the amplitude analysis in the model describing the $D^+ \pi^-$ wave together with virtual contributions from the $D^*(2007)^0$ and B^{*0} states, and components corresponding to the $D_2^*(2460)^0$, $D_1^*(2680)^0$, $D_3^*(2760)^0$, and $D_2^*(3000)^0$ resonances.

⁶ Systematic uncertainty not estimated.

⁷ Unnatural parity preferred.

⁸ Natural parity state. A state $D(3000)^+$ is possibly seen in $D^0 \pi^+$ final state.

NODE=M229W;LINKAGE=A

NODE=M229W;LINKAGE=C

NODE=M229W;LINKAGE=B

 $D(3000)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+} \pi^-$	seen

NODE=M229215;NODE=M229

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D(3000)^0$ POLARIZATION AMPLITUDE A_{D_J}

A polarization amplitude A_{D_J} is a parameter that depends on the initial polarization of the D_J . For D_J decays the helicity angle, θ_H , distribution varies like $1 + A_{D_J} \cos^2(\theta_H)$, where θ_H is the angle in the D_J rest frame between the two pions emitted in the $D_J \rightarrow D^* \pi$ and $D^* \rightarrow D \pi$ decays.

NODE=M229PAM

NODE=M229PAM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.5 ± 0.9	9.5k	⁹ AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$

NODE=M229PAM

⁹ Systematic uncertainty not estimated.

NODE=M229PAM;LINKAGE=A

 $D(3000)^0$ REFERENCES

AAIJ 16AH PR D94 072001 R. Aaij *et al.* (LHCb Collab.)
AAIJ 13CC JHEP 1309 145 R. Aaij *et al.* (LHCb Collab.)

NODE=M229

REFID=57518
REFID=55581

CHARMED, STRANGE MESONS
($C = \pm 1, S = \pm 1$)
(including possibly non- $q\bar{q}$ states)
 $D_s^+ = c\bar{s}, D_s^- = \bar{c}s,$ similarly for D_s^{*+} 's

$D_s^{*\pm}$

$I(J^P) = 0(1^-)$

$J^P = 1^-$ established by ABLIKIM 23AZ.

NODE=MXXX040

NODE=MXXX040

NODE=S074

NODE=S074

NODE=S074M

NODE=S074M

NODE=S074M

NODE=S074M;LINKAGE=E

NODE=S074DM

NODE=S074DM

NODE=S074DM

NODE=S074DM;LINKAGE=A

NODE=S074W

NODE=S074W

NODE=S074215;NODE=S074

NODE=S074

DESIG=1

DESIG=2

DESIG=3

DESIG=4

$D_s^{*\pm}$ MASS

The fit includes $D_s^\pm, D_s^0, D_s^{*\pm}, D^{*0}, D_s^{*+}, D_1(2420)^0, D_2^*(2460)^0,$
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.2±0.4 OUR FIT			
2106.6±2.1±2.7	¹ BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$
¹ Assuming $D_s^\pm$ mass = 1968.7 ± 0.9 MeV.			

$m_{D_s^{*\pm}} - m_{D_s^\pm}$

The fit includes $D_s^\pm, D_s^0, D_s^{*\pm}, D^{*0}, D_s^{*+}, D_1(2420)^0, D_2^*(2460)^0,$
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
143.8 ± 0.4 OUR FIT				
143.9 ± 0.4 OUR AVERAGE				
143.76 ± 0.39 ± 0.40		GRONBERG	95	CLE2 e^+e^-
144.22 ± 0.47 ± 0.37		BROWN	94	CLE2 e^+e^-
142.5 ± 0.8 ± 1.5		² ALBRECHT	88	ARG $e^+e^- \rightarrow D_s^\pm \gamma X$
139.5 ± 8.3 ± 9.7	60	AIHARA	84D	TPC $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
143.0 ± 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ² H
110 ± 46		BRANDELIK	79	DASP $e^+e^- \rightarrow D_s^\pm \gamma X$
² Result includes data of ALBRECHT 84B.				

$D_s^{*\pm}$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	GRONBERG	95	CLE2 e^+e^-
< 4.5	90	ALBRECHT	88	ARG $E_{cm}^{ee} = 10.2$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.9	90	BROWN	94	CLE2 e^+e^-
< 22	90	BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$

D_s^{*+} DECAY MODES

D_s^{*-} modes are charge conjugates of the modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D_s^+ \gamma$	(93.6 ± 0.4) %
$\Gamma_2 \quad D_s^+ \pi^0$	(5.77±0.35) %
$\Gamma_3 \quad D_s^+ e^+ e^-$	(6.7 ± 1.6) × 10 ⁻³
$\Gamma_4 \quad e^+ \nu_e$	(2.1 $\begin{smallmatrix} +1.2 \\ -0.9 \end{smallmatrix}$) × 10 ⁻⁵

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 4 measurements and one constraint to determine 3 parameters. The overall fit has a $\chi^2 = 0.0$ for 2 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	-91	
x_3	-38	-4
	x_1	x_2

D_s^{*+} BRANCHING RATIOS

NODE=S074220

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$				Γ_1 / Γ
VALUE (%)	DOCUMENT ID	TECN	COMMENT	

NODE=S074R1
NODE=S074R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	ASRATYAN	91	HLBC	$\bar{\nu}_\mu \text{Ne}$
seen	ALBRECHT	88	ARG	$e^+ e^- \rightarrow D_s^\pm \gamma X$
seen	AIHARA	84D		
seen	ALBRECHT	84B		
seen	BRANDELIK	79		

$\Gamma(D_s^+ \pi^0) / \Gamma(D_s^+ \gamma)$				Γ_2 / Γ_1
VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	

NODE=S074R2
NODE=S074R2**6.2 ± 0.4 OUR FIT**

[0.062 ± 0.008 OUR 2023 FIT]

NEW

6.2 ± 0.4 OUR AVERAGE

[0.062 ± 0.008 OUR 2023 AVERAGE]

NEW

6.16 ± 0.43 ± 0.18	ABLIKIM	23P	BES3	$e^+ e^-$
6.2 ± 0.5 ± 0.6	AUBERT, BE	05G	BABR	10.6 $e^+ e^- \rightarrow$ hadrons
6.2 $^{+2.0}_{-1.8}$ ± 2.2	GRONBERG	95	CLE2	$e^+ e^-$

$\Gamma(D_s^+ e^+ e^-) / \Gamma(D_s^+ \gamma)$				Γ_3 / Γ_1
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=S074R01
NODE=S074R01**7.2 ± 1.7 OUR FIT**

7.2 $^{+1.5}_{-1.3}$ ± 1.0	38	CRONIN-HEN..12	CLEO	4.17 $e^+ e^- \rightarrow$ hadrons

$\Gamma(e^+ \nu_e) / \Gamma_{\text{total}}$				Γ_4 / Γ
VALUE (units 10^{-5})		DOCUMENT ID	TECN	COMMENT

NODE=S074R02
NODE=S074R02

2.1 $^{+1.2}_{-0.9}$ ± 0.2		ABLIKIM	23BF BES3	$e^+ e^- \rightarrow D_s^- D_s^{*+}$

D_s^{*+} REFERENCES

NODE=S074

ABLIKIM	23AZ	PL B846 138245	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP	REFID=62420
ABLIKIM	23BF	PRL 131 141802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62430
ABLIKIM	23P	PR D107 032011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62059
CRONIN-HEN..12	PR D86 072005		D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=54627
AUBERT, BE	05G	PR D72 091101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50942
GRONBERG	95	PRL 75 3232	J. Gronberg <i>et al.</i>	(CLEO Collab.)	REFID=44568
BROWN	94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)	REFID=43868
ASRATYAN	91	PL B257 525	A.E. Asratyan <i>et al.</i>	(ITEP, BELG, SACL+)	REFID=41582
ALBRECHT	88	PL B207 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40269
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock <i>et al.</i>	(Mark III Collab.)	REFID=40005
ASRATYAN	85	PL 156B 441	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=22887
AIHARA	84D	PRL 53 2465	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=11561
ALBRECHT	84B	PL 146B 111	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22886
BRANDELIK	79	PL 80B 412	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=11442

$$D_{s0}^*(2317)^\pm$$

$$I(J^P) = 0(0^+)$$

J, P need confirmation.

AUBERT 06P and CHOI 15A do not observe neutral and doubly charged partners of the $D_{s0}^*(2317)^\pm$. See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M172

NODE=M172

$D_{s0}^*(2317)^\pm$ MASS

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172M

NODE=M172M

NODE=M172M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2317.8±0.5 OUR FIT				
2318.0±0.7 OUR AVERAGE				
2318.3±1.2±1.2	115	¹ ABLIKIM	18J BES3	4.6 $e^+e^- \rightarrow D_s^{*\pm} D_{s0}^*(2317)^\mp$
2319.6±0.2±1.4	3.1k	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+ \pi^0 X$
2317.3±0.4±0.8	1.0k	² AUBERT	04E BABR	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2317.2±1.3	88	³ AUBERT,B	04S BABR	$B \rightarrow D_{s0}^{(*)}(2317)^+ \bar{D}^{(*)}$
2317.2±0.5±0.9	761	⁴ MIKAMI	04 BELL	10.6 e^+e^-
2316.8±0.4±3.0	1.2k	^{4,5} AUBERT	03G BABR	10.6 e^+e^-
2317.6±1.3	273	^{4,6} AUBERT	03G BABR	10.6 e^+e^-
2319.8±2.1±2.0	24	⁴ KROKOVNY	03B BELL	10.6 e^+e^-
¹ From a fit of the D_s^* recoil mass where the $D_{s0}^*(2317)$ signal is described with a Crystal Ball function convolved with a Gaussian function.				
² Supersedes AUBERT 03G.				
³ Systematic errors not evaluated.				
⁴ Not independent of the corresponding $m_{D_{s0}^*(2317)} - m_{D_s}$.				
⁵ From $D_s^+ \rightarrow K^+ K^- \pi^+$ decay.				
⁶ From $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ decay.				

OCCUR=2

NODE=M172M;LINKAGE=A

NODE=M172M;LINKAGE=AU

NODE=M172M;LINKAGE=AB

NODE=M172M;LINKAGE=B1

NODE=M172M;LINKAGE=A1

NODE=M172M;LINKAGE=A2

$$m_{D_{s0}^*(2317)^\pm} - m_{D_s^\pm}$$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M172DM

NODE=M172DM

NODE=M172DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
349.4±0.5 OUR FIT				
349.2±0.7 OUR AVERAGE				
348.7±0.5±0.7	761	MIKAMI	04 BELL	10.6 e^+e^-
350.0±1.2±1.0	135	BESSON	03 CLE2	10.6 e^+e^-
351.3±2.1±1.9	24	⁷ KROKOVNY	03B BELL	10.6 e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
349.6±0.4±3.0	1267	^{8,9} AUBERT	03G BABR	10.6 e^+e^-
350.2±1.3	273	^{10,11} AUBERT	03G BABR	10.6 e^+e^-
⁷ Recalculated by us using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.				
⁸ From $D_s^+ \rightarrow K^+ K^- \pi^+$ decay.				
⁹ Recalculated by us using $m_{D_s^+} = 1967.20 \pm 0.03$ MeV.				
¹⁰ From $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ decay.				
¹¹ Recalculated by us using $m_{D_s^+} = 1967.4 \pm 0.2$ MeV. Systematic errors not estimated.				

OCCUR=2

NODE=M172DM;LINKAGE=K3

NODE=M172DM;LINKAGE=A1

NODE=M172DM;LINKAGE=C1

NODE=M172DM;LINKAGE=A2

NODE=M172DM;LINKAGE=C2

$D_{s0}^*(2317)^\pm$ WIDTH

NODE=M172W

NODE=M172W

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 3.8	95	3180	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+ \pi^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.6	90	761	MIKAMI	04 BELL	10.6 e^+e^-
<10			AUBERT	03G BABR	10.6 e^+e^-
< 7	90	135	BESSON	03 CLE2	10.6 e^+e^-

$D_{s0}^*(2317)^\pm$ DECAY MODES

NODE=M172215;NODE=M172

 $D_{s0}^*(2317)^-$ modes are charge conjugates of modes below.

NODE=M172

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad D_s^+ \pi^0$	$(100^{+0}_{-20}) \%$	
$\Gamma_2 \quad D_s^+ \gamma$	$< 5 \%$	90%
$\Gamma_3 \quad D_s^*(2112)^+ \gamma$	$< 6 \%$	90%
$\Gamma_4 \quad D_s^+ \gamma \gamma$	$< 18 \%$	95%
$\Gamma_5 \quad D_s^*(2112)^+ \pi^0$	$< 11 \%$	90%
$\Gamma_6 \quad D_s^+ \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%
$\Gamma_7 \quad D_s^+ \pi^0 \pi^0$	not seen	

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7;OUR EVAL;→ UNCHECKED ←

 $D_{s0}^*(2317)^\pm$ BRANCHING RATIOS

NODE=M172220

$\Gamma(D_s^+ \pi^0)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.00^{+0.00+0.00}_{-0.14-0.14}$	47	ABLIKIM	18J	BES3	$4.6 e^+ e^- \rightarrow D_s^{*\pm} D_{s0}^*(2317)^\mp$

NODE=M172R1
NODE=M172R1

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 1.5k AUBERT 03G BABR $10.6 e^+ e^-$

$\Gamma(D_s^+ \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.05	90	MIKAMI	04	BELL	$10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.14	95	AUBERT	06P	BABR	$10.6 e^+ e^-$
<0.052	90	BESSION	03	CLE2	$10.6 e^+ e^-$

NODE=M172R5
NODE=M172R5

$\Gamma(D_s^*(2112)^+ \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.059	90	BESSION	03	CLE2	$10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.16	95	AUBERT	06P	BABR	$10.6 e^+ e^-$
<0.18	90	MIKAMI	04	BELL	$10.6 e^+ e^-$

NODE=M172R6
NODE=M172R6

$\Gamma(D_s^+ \gamma \gamma)/\Gamma(D_s^+ \pi^0)$					Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.18	95	AUBERT	06P	BABR	$10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		AUBERT	03G	BABR	$10.6 e^+ e^-$

NODE=M172R7
NODE=M172R7

$\Gamma(D_s^*(2112)^+ \pi^0)/\Gamma(D_s^+ \pi^0)$					Γ_5/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.11	90	BESSION	03	CLE2	$10.6 e^+ e^-$

NODE=M172R8
NODE=M172R8

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma(D_s^+ \pi^0)$					Γ_6/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.004	90	MIKAMI	04	BELL	$10.6 e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.005	95	AUBERT	06P	BABR	$10.6 e^+ e^-$
<0.019	90	BESSION	03	CLE2	$10.6 e^+ e^-$

NODE=M172R9
NODE=M172R9

$\Gamma(D_s^+ \pi^0 \pi^0)/\Gamma(D_s^+ \pi^0)$					Γ_7/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	95	AUBERT	06P	BABR	$10.6 e^+ e^-$

NODE=M172R10
NODE=M172R10

$D_{s0}^*(2317)^\pm$ REFERENCES

ABLIKIM	18J	PR D97 051103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
CHOI	15A	PR D91 092011	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
AUBERT	03G	PRL 90 242001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)

NODE=M172

REFID=58895
REFID=56577
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49417
REFID=49583
REFID=49615

 $D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M173

NODE=M173

 $D_{s1}(2460)^\pm$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M173M

NODE=M173M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M173M

2459.5±0.6 OUR FIT Error includes scale factor of 1.1.**2459.6±0.9 OUR AVERAGE** Error includes scale factor of 1.3.2460.1±0.2±0.8 ¹ AUBERT 06P BABR 10.6 e^+e^- 2458.0±1.0±1.0 195 AUBERT 04E BABR 10.6 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

2459.5±1.2±3.7 920 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \gamma X$

OCCUR=2

2458.6±1.0±2.5 560 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^0 \gamma X$

OCCUR=3

2460.2±0.2±0.8 123 AUBERT 06P BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^+ \pi^- X$

OCCUR=4

2458.9±1.5 112 ² AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$ 2461.1±1.6 139 ³ AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$

OCCUR=2

2456.5±1.3±1.3 126 ^{4,5} MIKAMI 04 BELL 10.6 e^+e^- 2459.5±1.3±2.0 152 ^{6,7} MIKAMI 04 BELL 10.6 e^+e^-

OCCUR=2

2459.9±0.9±1.6 60 ^{6,7} MIKAMI 04 BELL 10.6 e^+e^-

OCCUR=3

2459.2±1.6±2.0 57 KROKOVNY 03B BELL 10.6 e^+e^- ¹ The average of the values obtained from the $D_s^+ \gamma$, $D_s^+ \pi^0 \gamma$, $D_s^+ \pi^+ \pi^-$ final state.² Systematic errors not evaluated. From the decay to $D_s^{*+} \pi^0$.³ Systematic errors not evaluated. From the decay to $D_s^+ \gamma$.⁴ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$.⁵ Using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.⁶ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^\pm}$.⁷ Using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.

NODE=M173M;LINKAGE=UB

NODE=M173M;LINKAGE=AU

NODE=M173M;LINKAGE=AB

NODE=M173M;LINKAGE=B1

NODE=M173M;LINKAGE=B2

NODE=M173M;LINKAGE=B3

NODE=M173M;LINKAGE=B4

 $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$

NODE=M173MD

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M173MD

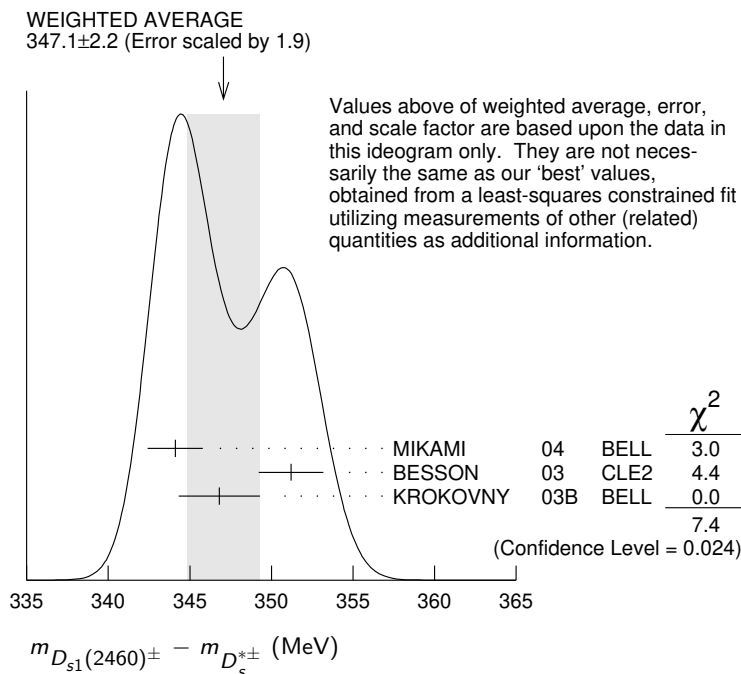
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M173MD

347.3±0.7 OUR FIT Error includes scale factor of 1.2.**347.1±2.2 OUR AVERAGE** Error includes scale factor of 1.9. See the ideogram below.344.1±1.3±1.1 126 MIKAMI 04 BELL 10.6 e^+e^- 351.2±1.7±1.0 41 BESSION 03 CLE2 10.6 e^+e^- 346.8±1.6±1.9 57 ⁸ KROKOVNY 03B BELL 10.6 e^+e^-

⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173MD;LINKAGE=K3



$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$

NODE=M173DM

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D_s^{*\pm}$, D_s^{*0} , $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
491.1±0.6 OUR FIT	Error includes scale factor of 1.1.			
491.3±1.4 OUR AVERAGE				
491.0±1.3±1.9	152	⁹ MIKAMI	04 BELL	10.6 e^+e^-
491.4±0.9±1.5	60	¹⁰ MIKAMI	04 BELL	10.6 e^+e^-

⁹ From the decay to $D_s^{\pm}\gamma$.

¹⁰ From the decay to $D_s^{\pm}\pi^+\pi^-$.

NODE=M173DM

OCCUR=2

NODE=M173DM;LINKAGE=M1

NODE=M173DM;LINKAGE=M2

$D_{s1}(2460)^{\pm}$ WIDTH

NODE=M173W

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
< 3.5	95	123	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6.3	95	560	AUBERT	06P BABR	10.6 $e^+e^- \rightarrow D_s^+\pi^0\gamma X$
<10		195	AUBERT	04E BABR	10.6 e^+e^-
< 5.5	90	126	MIKAMI	04 BELL	10.6 e^+e^-
< 7	90	41	BESSON	03 CLE2	10.6 e^+e^-

NODE=M173W

OCCUR=2

$D_{s1}(2460)^+$ DECAY MODES

NODE=M173215;NODE=M173

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

NODE=M173

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D_s^{*+}\pi^0$	(48 ±11) %	
Γ_2 $D_s^+\gamma$	(18 ± 4) %	
Γ_3 $D_s^+\pi^+\pi^-$	(4.3± 1.3) %	S=1.1
Γ_4 $D_s^{*+}\gamma$	< 8 %	CL=90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

Γ_5	$D_{s0}^*(2317)^+ \gamma$	$(3.7^{+5.0}_{-2.4}) \%$	DESIG=5
Γ_6	$D_s^+ \pi^0$		DESIG=7
Γ_7	$D_s^+ \pi^0 \pi^0$		DESIG=8
Γ_8	$D_s^+ \gamma \gamma$		DESIG=9

CONSTRAINED FIT INFORMATION

An overall fit to 7 branching ratios uses 8 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 3.4$ for 4 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	80		
x_3	68	62	
x_5	-3	25	26
	x_1	x_2	x_3

$D_{s1}(2460)^\pm$ BRANCHING RATIOS

NODE=M173220

$\Gamma(D_s^{*+} \pi^0) / \Gamma_{\text{total}}$ Γ_1 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.48 ± 0.11 OUR FIT**0.56 ± 0.13 ± 0.09** ¹¹ AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^*$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen 41 BESSON 03 CLE2 10.6 $e^+ e^-$ ¹¹ Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R1
NODE=M173R1

NODE=M173R1;LINKAGE=AU

$\Gamma(D_s^+ \gamma) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

0.18 ± 0.04 OUR FIT**0.16 ± 0.04 ± 0.03** ¹² AUBERT 06N BABR $B \rightarrow D_{s1}(2460)^- \bar{D}^*$ ¹² Evaluated in AUBERT 06N including measurements from AUBERT,B 04s.NODE=M173R6
NODE=M173R6

NODE=M173R6;LINKAGE=AU

$\Gamma(D_s^+ \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_2 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.38 ± 0.05 OUR FIT**0.44 ± 0.09 OUR AVERAGE**0.55 ± 0.13 ± 0.08 152 MIKAMI 04 BELL 10.6 $e^+ e^-$ 0.38 ± 0.11 ± 0.04 38 KROKOVNY 03B BELL 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.274 ± 0.045 ± 0.020 251 ¹³ AUBERT,B 04S BABR $B \rightarrow D_{s1}(2460)^+ \bar{D}^*$ < 0.49 90 BESSON 03 CLE2 10.6 $e^+ e^-$ ¹³ Used by AUBERT 06N in their measurement of $B(D_s^{*-} \pi^0)$ and $B(D_s^- \gamma)$.NODE=M173R2
NODE=M173R2

NODE=M173R2;LINKAGE=AU

$\Gamma(D_s^+ \pi^+ \pi^-) / \Gamma(D_s^{*+} \pi^0)$ Γ_3 / Γ_1

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.090 ± 0.020 OUR FIT Error includes scale factor of 1.2.**0.14 ± 0.04 ± 0.02** 60 MIKAMI 04 BELL 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.08 90 BESSON 03 CLE2 10.6 $e^+ e^-$ NODE=M173R3
NODE=M173R3

$\Gamma(D_s^{*+} \gamma) / \Gamma(D_s^{*+} \pi^0)$ Γ_4 / Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.16 90 BESSON 03 CLE2 10.6 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.31 90 MIKAMI 04 BELL 10.6 $e^+ e^-$ NODE=M173R4
NODE=M173R4

$$\Gamma(D_{s0}^*(2317)^+\gamma)/\Gamma(D_s^{*+}\pi^0)$$

$$\Gamma_5/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	95	AUBERT	04E	BABR 10.6 e ⁺ e ⁻
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.58	90	BESSION	03	CLE2 10.6 e ⁺ e ⁻

NODE=M173R5
NODE=M173R5

$$\Gamma(D_s^{*+}\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_1/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.93±0.09 OUR FIT			
0.97±0.09±0.05	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R7
NODE=M173R7

$$\Gamma(D_s^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_2/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ±0.04 OUR FIT			
0.337±0.036±0.038	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R8
NODE=M173R8

$$\Gamma(D_s^+\pi^+\pi^-)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_3/(\Gamma_1+\Gamma_5)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.083±0.017 OUR FIT	Error includes scale factor of 1.2.		
0.077±0.013±0.008	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R9
NODE=M173R9

$$\Gamma(D_s^{*+}\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_4/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R10
NODE=M173R10

$$\Gamma(D_{s0}^*(2317)^+\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_5/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.25	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R11
NODE=M173R11

$$\Gamma(D_s^+\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_6/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.042	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R12
NODE=M173R12

$$\Gamma(D_s^+\pi^0\pi^0)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_7/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.68	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R13
NODE=M173R13

$$\Gamma(D_s^+\gamma\gamma)/[\Gamma(D_s^{*+}\pi^0) + \Gamma(D_{s0}^*(2317)^+\gamma)]$$

$$\Gamma_8/(\Gamma_1+\Gamma_5)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.33	95	AUBERT	06P	BABR 10.6 e ⁺ e ⁻

NODE=M173R14
NODE=M173R14

$D_{s1}(2460)^\pm$ REFERENCES

NODE=M173

AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04E	PR D69 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04S	PRL 93 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIKAMI	04	PRL 92 012002	Y. Mikami <i>et al.</i>	(BELLE Collab.)
BESSION	03	PR D68 032002	D. Besson <i>et al.</i>	(CLEO Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)

REFID=51142
REFID=51144
REFID=49747
REFID=50195
REFID=49629
REFID=49583
REFID=49615

$D_{s1}(2536)^\pm$
 $I(J^P) = 0(1^+)$
 J, P need confirmation.

Seen in $D^*(2010)^+ K^0$, $D^*(2007)^0 K^+$, and $D_s^+ \pi^+ \pi^-$. Not seen in $D^+ K^0$ or $D^0 K^+$. $J^P = 1^+$ assignment strongly favored.

NODE=M121

NODE=M121

 $D_{s1}(2536)^\pm$ MASS

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121M

NODE=M121M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2535.11±0.06 OUR FIT				
2535.21±0.28 OUR AVERAGE				
2537.7 ±0.5 ±3.1	24	¹ ABLIKIM	19P BES3	$4.6 e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$
2535.7 ±0.6 ±0.5	46	² ABAZOV	09G D0	$B_s^0 \rightarrow D_{s1}^- \mu^+ \nu_\mu X$
2534.78±0.31±0.40	182	AUBERT	08B BABR	$B \rightarrow \bar{D}^{(*)} D^* K$
2534.6 ±0.3 ±0.7	193	AUBERT	06P BABR	$10.6 e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$
2535.3 ±0.7	92	³ HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2534.2 ±1.2	9	ASRATYAN	94 BEBC	$\nu N \rightarrow D^{*+} K^0 X$, $D^{*0} K^\pm X$
2535 ±0.6 ±1	75	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2535.2 ±0.5 ±1.5	28	ALBRECHT	92R ARG	$10.4 e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
2536.6 ±0.7 ±0.4		AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535.9 ±0.6 ±2.0		ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2534.1 ±0.6	116	⁴ AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2535.08±0.01±0.15	8038	⁵ LEES	11B BABR	$10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$
2535.57 ^{+0.44} _{-0.41} ±0.10	236	⁶ CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X$, $D^{*0} K^+ X$
2535.3 ±0.2 ±0.5	134	⁷ ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*0} K^+ X$
2534.8 ±0.6 ±0.6	44	⁸ ALEXANDER	93 CLE2	$e^+ e^- \rightarrow D^{*+} K^0 X$
2535 ± 28		⁹ ASRATYAN	88 HLBC	$\nu N \rightarrow D_s \gamma \gamma X$

NODE=M121M

OCCUR=2

NODE=M121M;LINKAGE=D

NODE=M121M;LINKAGE=AB

NODE=M121M;LINKAGE=HI

NODE=M121M;LINKAGE=AU

NODE=M121M;LINKAGE=LE

NODE=M121M;LINKAGE=CH

NODE=M121M;LINKAGE=A

NODE=M121M;LINKAGE=C

NODE=M121M;LINKAGE=B

¹ From a fit of the D_s^+ recoil mass distribution with an incoherent sum of the S -wave and D -wave Breit-Wigner line shapes.

² Using the $D^*(2010)^\pm$ mass of 2010.0 ± 0.4 MeV from PDG 06.

³ Calculated using $m(D^*(2010)^\pm) = 2010.0 \pm 0.5$ MeV, $m(D^*(2007)^0) = 2006.7 \pm 0.5$ MeV, and the mass difference below.

⁴ Systematic uncertainties not evaluated.

⁵ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ below and $m(D^{*+})_{PDG} = 2010.25 \pm 0.14$ MeV. Assuming S -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to $L=0$.

⁶ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV.

⁷ Calculated using $m(D^*(2007)^0) = 2006.6 \pm 0.5$ MeV and the mass difference below.

⁸ Calculated using $m(D^*(2010)^\pm) = 2010.1 \pm 0.6$ MeV and the mass difference below.

⁹ Not seen in $D^* K$.

 $m_{D_{s1}(2536)^\pm} - m_{D_s^*(2111)}$

The fit includes $D^\pm$, D^0 , $D_s^\pm$, $D^{*\pm}$, D^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DM

NODE=M121DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
422.9± 0.4 OUR FIT			
424 ±28	ASRATYAN	88 HLBC	$D_s^{*\pm} \gamma$

NODE=M121DM

 $m_{D_{s1}(2536)^\pm} - m_{D^*(2010)^\pm}$

NODE=M121DN

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DN

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
524.85±0.04 OUR FIT				
524.84±0.04 OUR AVERAGE				
524.83±0.01±0.04	8038	¹⁰ LEES	11B BABR	10.6 $e^+e^- \rightarrow D^{*+} K_S^0 X$
525.30 ^{+0.44} _{-0.41} ±0.10	236 ± 30	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$
525.3 ±0.6 ±0.1	41	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*+} K^0 X$
524.7 ±0.6 ±0.2	44	ALEXANDER	93 CLE2	$e^+e^- \rightarrow D^{*+} K_S^0 X$
¹⁰ Assuming S -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to $L=0$.				

NODE=M121DN

OCCUR=2

NODE=M121DN;LINKAGE=LE

$m_{D_{s1}(2536)^\pm} - m_{D^{*}(2007)^0}$

The fit includes $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$,
and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

NODE=M121DP

NODE=M121DP

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
528.26±0.05 OUR FIT	Error includes scale factor of 1.1.			
528.68±0.28 OUR AVERAGE				
528.7 ±1.9 ±0.5	51	HEISTER	02B ALEP	$e^+e^- \rightarrow D^{*0} K^+ X$
527.3 ±2.2	29	ACKERSTAFF	97W OPAL	$e^+e^- \rightarrow D^{*0} K^+ X$
528.7 ±0.2 ±0.2	134	ALEXANDER	93 CLE2	$e^+e^- \rightarrow D^{*0} K^+ X$

NODE=M121DP

OCCUR=2

$D_{s1}(2536)^\pm$ WIDTH

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.92±0.05 OUR AVERAGE				
1.7 ±1.2 ±0.6	24	¹¹ ABLIKIM	19P BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
0.92±0.03±0.04	8038	¹² LEES	11B BABR	10.6 $e^+e^- \rightarrow D^{*+} K_S^0 X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.75±0.23	116	¹³ AUSHEV	11 BELL	$B \rightarrow D_{s1}(2536)^+ D^{(*)}$
< 2.5	95	193 AUBERT	06P BABR	10.6 $e^+e^- \rightarrow$ $D_s^+ \pi^+ \pi^- X$
< 3.2	90	75 FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 2.3	90	ALEXANDER	93 CLEO	$e^+e^- \rightarrow D^{*0} K^+ X$
< 3.9	90	ALBRECHT	92R ARG	10.4 $e^+e^- \rightarrow D^{*0} K^+ X$
< 5.44	90	AVERY	90 CLEO	$e^+e^- \rightarrow D^{*+} K^0 X$
< 4.6	90	ALBRECHT	89E ARG	$D_{s1}^* \rightarrow D^*(2010) K^0$

NODE=M121W

NODE=M121W

¹¹ From a fit of the D_s^+ recoil mass distribution with an incoherent sum of the S -wave and S -wave Breit-Wigner line shapes.

¹² Assuming S -wave decay of the $D_{s1}(2536)$ to $D^{*+} K_S^0$, using a Breit-Wigner line shape corresponding to $L=0$.

¹³ Systematic uncertainties not evaluated.

NODE=M121W;LINKAGE=A

NODE=M121W;LINKAGE=LE

NODE=M121W;LINKAGE=AU

$D_{s1}(2536)^+$ DECAY MODES

Branching fractions are given relative to the one **DEFINED AS 1**.
 $D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

NODE=M121215;NODE=M121

NODE=M121

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $D^*(2010)^+ K^0$	0.85 ±0.12	DESIG=1
Γ_2 $(D^*(2010)^+ K^0)_{S-wave}$	0.61 ±0.09	DESIG=7
Γ_3 $(D^*(2010)^+ K^0)_{D-wave}$		DESIG=9
Γ_4 $K_S^0 D^*(2010)^+$	0.48 ±0.07	DESIG=10
Γ_5 $D^+ \pi^- K^+$	0.028±0.005	DESIG=8
Γ_6 $D^*(2007)^0 K^+$	DEFINED AS 1	DESIG=4
Γ_7 $D^+ K^0$	<0.34	90% DESIG=2
Γ_8 $D^0 K^+$	<0.12	90% DESIG=5
Γ_9 $D_s^{*+} \gamma$	possibly seen	DESIG=3
Γ_{10} $D_s^+ \pi^+ \pi^-$	seen	DESIG=6

$D_{s1}(2536)^+$ BRANCHING RATIOS

NODE=M121220

$$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$$

 Γ_6/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
1.18±0.16 OUR AVERAGE				
0.88±0.24±0.08	116	AUSHEV	11	BELL $B \rightarrow D_{s1}(2536)^+ D^{(*)}$
2.3 ±0.6 ±0.3	236 ± 30	CHEKANOV	09	ZEUS $e^\pm p \rightarrow D^{*+} K_S^0 X$,
				$D^{*0} K^+ X$
1.32±0.47±0.23	92	¹⁴ HEISTER	02B	ALEP $e^+ e^- \rightarrow D^{*+} K^0 X$,
				$D^{*0} K^+ X$
1.9 $^{+1.1}_{-0.9}$ ±0.4	35	¹⁴ ACKERSTAFF	97W	OPAL $e^+ e^- \rightarrow D^{*0} K^+ X$,
				$D^{*+} K^0 X$
1.1 ±0.3		ALEXANDER	93	CLEO $e^+ e^- \rightarrow$
				$D^{*0} K^+ X, D^{*+} K^0 X$
1.4 ±0.3 ±0.2		¹⁵ ALBRECHT	92R	ARG 10.4 $e^+ e^- \rightarrow$
				$D^{*0} K^+ X, D^{*+} K^0 X$

¹⁴ Ratio of the production rates measured in Z^0 decays.¹⁵ Evaluated by us from published inclusive cross-sections.NODE=M121R6;LINKAGE=6A
NODE=M121R6;LINKAGE=A

$$\Gamma(K_S^0 D^*(2010)^+)/\Gamma(D^*(2007)^0 K^+)$$

 Γ_4/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.48±0.07±0.02	GAO	23	BELL $e^+ e^-$ at 10.52 GeV

NODE=M121R00
NODE=M121R00

$$\Gamma((D^*(2010)^+ K^0)_{S\text{-wave}})/\Gamma(D^*(2010)^+ K^0)$$

 Γ_2/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.72±0.05±0.01	5485	BALAGURA	08	BELL 10.6 $e^+ e^- \rightarrow D^{*+} K^0 X$

NODE=M121R8
NODE=M121R8

$$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$$

 Γ_5/Γ_1

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
3.27±0.18±0.37	1264	BALAGURA	08	BELL 10.6 $e^+ e^- \rightarrow D^+ \pi^- K^+ X$

NODE=M121R9
NODE=M121R9

$$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$$

 Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.40	90	ALEXANDER	93	CLEO $e^+ e^- \rightarrow D^{*+} K^0 X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.43	90	ALBRECHT	89E	ARG $D_{s1}^* \rightarrow D^*(2010) K^0$

NODE=M121R1
NODE=M121R1

$$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$$

 Γ_8/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.12	90	ALEXANDER	93	CLEO $e^+ e^- \rightarrow D^{*0} K^+ X$

NODE=M121R4
NODE=M121R4

$$\Gamma(D_s^{*+} \gamma)/\Gamma_{\text{total}}$$

 Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ASRATYAN	88	HLBC $\nu N \rightarrow D_s \gamma \gamma X$

NODE=M121R3
NODE=M121R3

$$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$$

 Γ_9/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42	90	ALEXANDER	93	CLEO $e^+ e^- \rightarrow D^{*0} K^+ X$

NODE=M121R5
NODE=M121R5

$$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$$

 Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	06P	BABR 10.6 $e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$

NODE=M121R7
NODE=M121R7 **$D_{s1}(2536)^\pm$ REFERENCES**

NODE=M121

GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)	REFID=62519
ABLIKIM	19P	CP C43 031001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59617
AUSHEV	11	PR D83 051102	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=16505
LEES	11B	PR D83 072003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16773
ABAZOV	09G	PRL 102 051801	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=52652
CHEKANOV	09	EPJ C60 25	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52733
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BALAGURA	08	PR D77 032001	V. Balagura <i>et al.</i>	(BELLE Collab.)	REFID=52133
AUBERT	06P	PR D74 032007	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51144
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48562
ACKERSTAFF	97W	ZPHY C76 425	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=45788
ASRATYAN	94	ZPHY C61 563	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)	REFID=43667
FRABETTI	94B	PRL 72 324	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=43687
ALEXANDER	93	PL B303 377	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=43316
ALBRECHT	92R	PL B297 425	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=43179
AVERY	90	PR D41 774	P. Avery, D. Besson	(CLEO Collab.)	REFID=41013
ALBRECHT	89E	PL B230 162	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40914
ASRATYAN	88	ZPHY C40 483	A.E. Asratyan <i>et al.</i>	(ITEP, SERP)	REFID=40916

$D_{s2}^*(2573)$

$$I(J^P) = 0(2^+)$$

NODE=M148

 $D_{s2}^*(2573)$ MASS

NODE=M148M

NODE=M148M

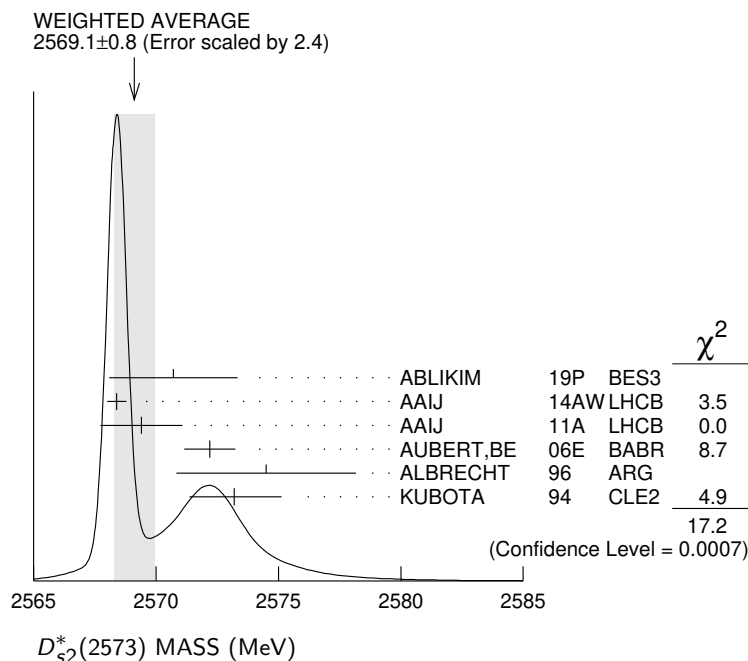
VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2569.1 ± 0.8 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
2570.7 $\pm 2.0 \pm 1.7$	62	¹ ABLIKIM	19P BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
2568.39 $\pm 0.29 \pm 0.26$		AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
2569.4 $\pm 1.6 \pm 0.5$	82	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$
2572.2 $\pm 0.3 \pm 1.0$		AUBERT,BE	06E BABR	$e^+e^- \rightarrow D K X$
2574.5 $\pm 3.3 \pm 1.6$		ALBRECHT	96 ARG	$e^+e^- \rightarrow D^0 K^+ X$
2573.2 $^{+1.7}_{-1.6} \pm 0.9$	217	KUBOTA	94 CLE2	$e^+e^- \sim 10.5$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2570.0 ± 4.3	25	² EVDOKIMOV	04 SELX	600 $\Sigma^- A \rightarrow D^0 K^+ X$
2568.6 ± 3.2	64	³ HEISTER	02B ALEP	$e^+e^- \rightarrow D^0 K^+ X$

¹ From a fit of the D_s^+ recoil mass distribution .² Not independent of the mass difference below.³ Calculated using $m_{D^0} = 1864.5 \pm 0.5$ MeV and the mass difference below.

NODE=M148M;LINKAGE=A

NODE=M148M;LINKAGE=EV

NODE=M148M;LINKAGE=HI

 $m_{D_{s2}^*(2573)} - m_{D^0}$

NODE=M148DM

NODE=M148DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
704 $\pm 3 \pm 1$	64	HEISTER	02B ALEP	$e^+e^- \rightarrow D^0 K^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
705.4 ± 4.3	25	¹ EVDOKIMOV	04 SELX	600 $\Sigma^- A \rightarrow D^0 K^+ X$
¹ Systematic errors not estimated.				

NODE=M148DM;LINKAGE=EV

 $D_{s2}^*(2573)$ WIDTH

NODE=M148W

NODE=M148W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
16.9± 0.7 OUR AVERAGE				
17.2 $\pm 3.6 \pm 1.1$	62	¹ ABLIKIM	19P BES3	4.6 $e^+e^- \rightarrow D_s^+ \bar{D}^0 K^-$
16.9 $\pm 0.5 \pm 0.6$		AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
12.1 $\pm 4.5 \pm 1.6$	82	AAIJ	11A LHCb	$B_s \rightarrow D_{s2}^*(2573) \mu \bar{\nu} X$

27.1±0.6±5.6		AUBERT,BE	06E	BABR	$e^+e^- \rightarrow DKX$
10.4±8.3±3.0		ALBRECHT	96	ARG	$e^+e^- \rightarrow D^0K^+X$
16 ⁺⁵ ₋₄ ±3	217	KUBOTA	94	CLE2	$e^+e^- \sim 10.5 \text{ GeV}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

14 ⁺⁹ ₋₆	25	² EVDOKIMOV	04	SELX	600 $\Sigma^- A \rightarrow D^0K^+X$

¹ From a fit of the D_s^+ recoil mass distribution .

² Systematic errors not estimated.

NODE=M148W;LINKAGE=A
NODE=M148W;LINKAGE=EV

$D_{s2}^*(2573)^+$ DECAY MODES

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

NODE=M148215;NODE=M148

NODE=M148

Mode	Fraction (Γ_i/Γ)
Γ_1 D^0K^+	seen
Γ_2 $D^*(2007)^0K^+$	not seen
Γ_3 $D^+K_S^0$	seen
Γ_4 $D^{*+}K_S^0$	seen

DESIG=1
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←

$D_{s2}^*(2573)^+$ BRANCHING RATIOS

NODE=M148220

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	217	KUBOTA	94	CLE2	$\pm$	$e^+ e^- \sim 10.5 \text{ GeV}$

NODE=M148R2
NODE=M148R2

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$						Γ_2/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
<0.33	90	KUBOTA	94	CLE2	+	$e^+e^- \sim 10.5 \text{ GeV}$

NODE=M148R1
NODE=M148R1

$\Gamma(D^+K_S^0)/\Gamma(D^0K^+)$	Γ_3/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
0.49±0.10±0.02	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M148R01
NODE=M148R01

$\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$				Γ_4/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.044 \pm 0.005 \pm 0.011$	2000	¹ AAIJ	16AW LHCB	$pp \rightarrow D^{*+}K_S^0 X$ at 7, 8 TeV

NODE=M148R00
NODE=M148R00

¹ First observation of the $D_{s2}^*(2573)^+ \rightarrow D^{*+}K_S^0$ decay with a significance of 6.9 σ .

NODE=M148R00;LINKAGE=A

$D_{s2}^*(2573)$ REFERENCES

NODE=M148

GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)	REFID=62519
ABLIKIM	19P	CP C43 031001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59617
AAIJ	16AW	JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60464
AAIJ	14AW	PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=56105
AAIJ	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=16665
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51512
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)	REFID=50337
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48562
ALBRECHT	96	ZPHY C69 405	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44631
KUBOTA	94	PRL 72 1972	Y. Kubota <i>et al.</i>	(CLEO Collab.)	REFID=43781

$D_{s0}(2590)^+$

$I(J^P) = 0(0^-)$

OMITTED FROM SUMMARY TABLE

 $D_{s0}(2590)^+$ MASS

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT
2591±6±7	444	¹ AAIJ	21A LHCb	$B^0 \rightarrow D^-(D^+ K^+ \pi^-)$

¹ The mass is calculated from the position of the T-matrix pole $D_{s0}(2590)^+$ WIDTH

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT
89±16±12	444	¹ AAIJ	21A LHCb	$B^0 \rightarrow D^-(D^+ K^+ \pi^-)$

¹ The width is calculated from the position of the T-matrix pole $D_{s0}(2590)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^+ K^+ \pi^-$	seen

$\Gamma(D^+ K^+ \pi^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	444	AAIJ	21A LHCb	$B^0 \rightarrow D^-(D^+ K^+ \pi^-)$

 $D_{s0}(2590)^+$ REFERENCESAAIJ 21A PRL 126 122002 R. Aaij *et al.* (LHCb Collab.) $D_{s1}^*(2700)^\pm$

$I(J^P) = 0(1^-)$

 $D_{s1}^*(2700)^+$ MASS

VALUE (MeV)	EPTS	DOCUMENT ID	TECN	COMMENT
2714 ± 5 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
2732.3± 4.3± 5.8 15.7k		AAIJ	16AW LHCb	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
2699 $^{+14}_{-7}$		¹ LEES	15C BABR	$B \rightarrow D D^0 K^+$
2709.2± 1.9± 4.5 52k		² AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
2710 ± 2 $^{+12}_{-7}$ 10.4k		³ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
2708 ± 9 $^{+11}_{-10}$ 182		BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2694 ± 8 $^{+13}_{-3}$		LEES	15C BABR	$B^0 \rightarrow D^- D^0 K^+$
2707 ± 8 ± 8		LEES	15C BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
2688 ± 4 ± 3		⁴ AUBERT,BE	06E BABR	10.6 $e^+ e^- \rightarrow DKX$

¹ From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.² From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.³ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.⁴ Superseded by AUBERT 09AR.

NODE=M256

NODE=M256M

NODE=M256M

NODE=M256M;LINKAGE=B

NODE=M256W

NODE=M256W

NODE=M256W;LINKAGE=B

NODE=M256215;NODE=M256

DESIG=1

NODE=M256R01

NODE=M256R01

NODE=M256

REFID=61092

NODE=M182

NODE=M182M

NODE=M182M

OCCUR=2

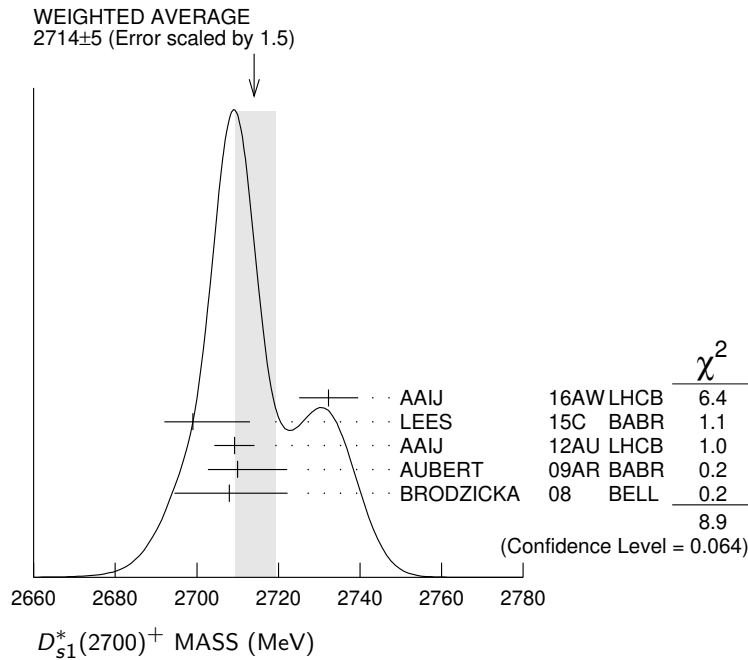
OCCUR=3

NODE=M182M;LINKAGE=B

NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU



$D_{s1}^*(2700)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
122 ±10 OUR AVERAGE				
136 ±19 ±24	15.7k	AAIJ	16AW LHCb	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
127 ⁺²⁴ ₋₁₉		¹ LEES	15C BABR	$B \rightarrow D D^0 K^+$
115.8 ± 7.3 ±12.1	52k	² AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
149 ± 7 ⁺³⁹ ₋₅₂	10.4k	³ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$
108 ±23 ⁺³⁶ ₋₃₁	182	BRODZICKA	08 BELL	$B^+ \rightarrow D^0 \bar{D}^0 K^+$
145 ±24 ⁺²² ₋₁₄		LEES	15C BABR	$B^0 \rightarrow D^- D^0 K^+$
113 ±21 ⁺²⁰ ₋₁₆		LEES	15C BABR	$B^+ \rightarrow \bar{D}^0 D^0 K^+$
112 ± 7 ±36		⁴ AUBERT, BE	06E BABR	$10.6 e^+ e^- \rightarrow D K X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ From a combined analysis of $B^0 \rightarrow D^- D^0 K^+$ and $B^+ \rightarrow \bar{D}^0 D^0 K^+$.

² From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

³ From simultaneous fits to the two DK mass spectra and to the total $D^* K$ mass spectrum.

⁴ Superseded by AUBERT 09AR.

$D_{s1}^*(2700)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 DK	
Γ_2 $D^0 K^+$	seen
Γ_3 $D^+ K_S^0$	seen
Γ_4 $D^* K$	
Γ_5 $D^{*0} K^+$	seen
Γ_6 $D^{*+} K_S^0$	seen

$D_{s1}^*(2700)^\pm$ BRANCHING RATIOS

$\Gamma(D^* K)/\Gamma(DK)$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
0.91 ±0.13 ±0.12	10.4k	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M182W

NODE=M182W

OCCUR=2

OCCUR=3

NODE=M182W;LINKAGE=A

NODE=M182W;LINKAGE=AA

NODE=M182W;LINKAGE=AB

NODE=M182W;LINKAGE=AU

NODE=M182215;NODE=M182

DESIG=2

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

NODE=M182225

NODE=M182R01

NODE=M182R01

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.88 \pm 0.14 \pm 0.14$	7716	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

¹ From the $D^{*0}K^+$ and D^0K^+ , where $D^{*0} \rightarrow D^0\pi^0$.

 Γ_5/Γ_2

NODE=M182R02
NODE=M182R02

NODE=M182R02;LINKAGE=AU

 $\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.14 \pm 0.39 \pm 0.23$	2700	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$

¹ From the $D^{*+}K_S^0$ and $D^+K_S^0$, where $D^{*+} \rightarrow D^+\pi^0$.

 Γ_6/Γ_3

NODE=M182R03
NODE=M182R03

NODE=M182R03;LINKAGE=AU

 $D_{s1}^*(2700)^\pm$ REFERENCES

AAIJ	16AW JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	15C PR D91 052002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	12AU JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
BRODZICKA	08 PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)
AUBERT,BE	06E PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M182

REFID=60464
REFID=56412
REFID=54735
REFID=53135
REFID=52144
REFID=51512

NODE=M196

 $D_{s1}^*(2860)^\pm$ $I(J^P) = 0(1^-)$

OMITTED FROM SUMMARY TABLE

was $D_{sJ}^*(2860)$

J^P consistent with 1^- from angular analysis of AAIJ 14AW.

NODE=M196

 $D_{s1}^*(2860)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2859 \pm 12 \pm 24$	¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196M

NODE=M196M

NODE=M196M;LINKAGE=A

 $D_{s1}^*(2860)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
160 ± 80 OUR AVERAGE	[159 $\pm$ 80 MeV OUR 2023 AVERAGE]		
$159 \pm 23 \pm 77$	¹ AAIJ	14AW LHCB	$B_S^0 \rightarrow \bar{D}^0 K^- \pi^+$

¹ Separated from the spin-3 component $D_{s3}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

NODE=M196W

NODE=M196W

NEW

NODE=M196W;LINKAGE=A

 $D_{s1}^*(2860)^\pm$ REFERENCES

AAIJ	14AW PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP

NODE=M196

REFID=56105

$$D_{s3}^*(2860)^\pm$$

$$I(J^P) = 0(3^-)$$

J^P consistent with 3^- from angular analysis of AAIJ 14AW. Observed by AUBERT, BE 06E and AUBERT 09AR in inclusive production of DK and D^*K in e^+e^- annihilation.

NODE=M226

NODE=M226

$D_{s3}^*(2860)^+$ MASS

NODE=M226M

NODE=M226M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2860.5±2.6±6.5		¹ AAIJ	14AW LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2867.1±4.3±1.9	3.1k	AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
2866.1±1.0±6.3	36k	^{2,3} AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
2862 ±2 $\pm \frac{+5}{-2}$	3122	^{2,4} AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$
2856.6±1.5±5.0		⁵ AUBERT, BE	06E BABR	$e^+e^- \rightarrow DK X$

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

² Possible contribution from the $D_{s1}^*(2860)$ state.

³ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M226M;LINKAGE=A

NODE=M226M;LINKAGE=D

NODE=M226M;LINKAGE=E

NODE=M226M;LINKAGE=C

NODE=M226M;LINKAGE=B

$D_{s3}^*(2860)^+$ WIDTH

NODE=M226W

NODE=M226W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
53 ± 7 ± 7		¹ AAIJ	14AW LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
50 ±11 ±13	3.1k	AAIJ	16AW LHCB	$pp \rightarrow D^{*+} K_S^0 X$ at 7, 8 TeV
69.9± 3.2± 6.6	36k	^{2,3} AAIJ	12AU LHCB	$pp \rightarrow (DK)^+ X$ at 7 TeV
48 ± 3 ± 6	3122	^{2,4} AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$
47 ± 7 ±10		⁵ AUBERT, BE	06E BABR	$e^+e^- \rightarrow DK X$

¹ Separated from the spin-1 component $D_{s1}^*(2860)^-$ by a fit of the helicity angle of the $\bar{D}^0 K^-$ system, with a statistical significance of the spin-3 and spin-1 components in excess of 10σ .

² Possible contribution from the $D_{s1}^*(2860)$ state.

³ From the combined fit of the $D^+ K_S^0$ and $D^0 K^+$ modes in the model including the $D_{s2}^*(2573)^+$, $D_{s1}^*(2700)^+$ and spin-0 $D_{sJ}^*(2860)^+$.

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M226W;LINKAGE=A

NODE=M226W;LINKAGE=D

NODE=M226W;LINKAGE=E

NODE=M226W;LINKAGE=C

NODE=M226W;LINKAGE=B

$D_{s3}^*(2860)^\pm$ DECAY MODES

NODE=M226215;NODE=M226

Mode	Fraction (Γ_i/Γ)
Γ_1 DK	
Γ_2 $D^0 K^+$	seen
Γ_3 $D^+ K_S^0$	seen
Γ_4 $D^* K$	
Γ_5 $D^{*0} K^+$	seen
Γ_6 $D^{*+} K_S^0$	seen

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6;OUR EVAL;→ UNCHECKED ←

$D_{s3}^*(2860)^\pm$ BRANCHING RATIOS

$\Gamma(D^*K)/\Gamma(DK)$					Γ_4/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.10±0.15±0.19	3122	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$	
¹ From the average of the corresponding ratios with $D^{(*)0}K^+$ and $D^{(*)+}K_S^0$.					
$\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$					Γ_5/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.04±0.17±0.20	2241	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$	
¹ From the $D^{*0}K^+$ and D^0K^+ , where $D^{*0} \rightarrow D^0\pi^0$.					
$\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$					Γ_6/Γ_3
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.38±0.35±0.49	881	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)}KX$	
¹ From the $D^{*+}K_S^0$ and $D^+K_S^0$, where $D^{*+} \rightarrow D^+\pi^0$.					

NODE=M226225

NODE=M226R01
NODE=M226R01

NODE=M226R01;LINKAGE=AU

NODE=M226R02
NODE=M226R02

NODE=M226R02;LINKAGE=AU

NODE=M226R03
NODE=M226R03

NODE=M226R03;LINKAGE=AU

$D_{s3}^*(2860)^\pm$ REFERENCES

AAIJ	16AW JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AW PRL 113 162001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
AAIJ	12AU JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06E PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M226

REFID=60464
REFID=56105
REFID=54735
REFID=53135
REFID=51512

NODE=M197

$D_{sJ}(3040)^\pm$

$$I(J^P) = 0(?^?)$$

OMITTED FROM SUMMARY TABLE

Observed by AUBERT 09AR in inclusive production of D^*K in e^+e^- annihilation.

NODE=M197

$D_{sJ}(3040)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3044±8⁺³⁰₋₅	AUBERT	09AR BABR	$e^+e^- \rightarrow D^*KX$

NODE=M197M

NODE=M197M

$D_{sJ}(3040)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
240±60 OUR AVERAGE [239 ± 60 MeV OUR 2023 AVERAGE]			
239±35⁺⁴⁶₋₄₂	AUBERT	09AR BABR	$e^+e^- \rightarrow D^*KX$

NODE=M197W

NODE=M197W
NEW

$D_{sJ}(3040)^\pm$ DECAY MODES

Mode	
Γ_1	D^*K
Γ_2	$D^{*0}K^+$
Γ_3	$D^{*+}K_S^0$

NODE=M197215;NODE=M197

DESIG=1
DESIG=2
DESIG=3

$D_{sJ}(3040)^\pm$ REFERENCES

AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)

NODE=M197

REFID=53135

BOTTOM MESONS

($B = \pm 1$)

$B^+ = u\bar{b}$, $B^0 = d\bar{b}$, $\bar{B}^0 = \bar{d}b$, $B^- = \bar{u}b$, similarly for B^{*} 's

$B_1(5721)$

$I(J^P) = \frac{1}{2}(1^+)$
I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

$B_1(5721)$ MASS

$B_1(5721)^+$ mass

OUR FIT uses $m_{B^{*0}}$ and $m_{B_1^+} - m_{B^{*0}}$ to determine $m_{B_1(5721)^+}$.

VALUE (MeV)	DOCUMENT ID

5726.0 $^{+2.5}_{-2.7}$ OUR FIT

[5725.9 $^{+2.5}_{-2.7}$ MeV OUR 2023 FIT]

$m_{B_1^+} - m_{B^{*0}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

401.2 $^{+2.4}_{-2.7}$ OUR FIT

401.2 $^{+2.4}_{-2.7}$ OUR AVERAGE

400.5 $\pm 1.8 \pm 3.1$ 8k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

402 ± 3 $^{+1}_{-3}$ ² AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeV

¹ AAIJ 15AB reports $[m_{B_1^+} - m_{B^0}] - (m_{B^{*0}} - m_{B^0}) - m_{\pi^+} = 260.9 \pm 1.8 \pm 3.1$

MeV which we adjust by the π^+ mass and assume $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_1(5721)^+} - m_{B^{*0}} - m_{\pi^+} = 262 \pm 3^{+1}_{-3}$ MeV which we adjusted by the π^+ mass.

$B_1(5721)^0$ mass

OUR FIT uses mass differences measurements listed below to determine the mass $m_{B_1(5721)^0}$.

VALUE (MeV)	DOCUMENT ID

5726.1 ± 1.2 OUR FIT Error includes scale factor of 1.2. [5726.1 $\pm$ 1.3 MeV OUR 2023 FIT Scale factor = 1.2]

$m_{B_1^0} - m_{B^+}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

446.7 ± 1.2 OUR FIT Error includes scale factor of 1.2. [446.7 $\pm$ 1.3 MeV OUR 2023 FIT Scale factor = 1.2]

441.5 $\pm 2.4 \pm 1.3$ ¹ ABAZOV 07T D0 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

446.2 $^{+1.9+1.0}_{-2.1-1.2}$ ¹ AALTONEN 09D CDF Repl. by AALTONEN 14l

¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$.

$m_{B_1^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

401.4 ± 1.2 OUR FIT Error includes scale factor of 1.2.

402.8 ± 1.1 OUR AVERAGE

403.4 $\pm 0.7 \pm 1.5$ 35k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

402.3 ± 0.9 $^{+1.1}_{-1.2}$ ² AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeV

NODE=MXXX045

NODE=MXXX045

NODE=M244

NODE=M244

NODE=M244205

NODE=M244M+

NODE=M244M+
NODE=M244M+

NEW

NODE=M244DM+
NODE=M244DM+

NODE=M244DM+;LINKAGE=A

NODE=M244DM+;LINKAGE=AA

NODE=M244M0

NODE=M244M0

NODE=M244M0

NEW

NODE=M244DM0
NODE=M244DM0

NEW

NODE=M244DM0;LINKAGE=AA

NODE=M244DM1
NODE=M244DM1

¹ AAIJ 15AB reports $[m_{B_1^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 263.9 \pm 0.7 \pm 1.4$ MeV which we adjust by the π^- mass and $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14I reports $m_{B_1(5721)^0} - m_{B^{*+}} - m_{\pi^-} = 262.7 \pm 0.9^{+1.1}_{-1.2}$ MeV which we adjusted by the π^- mass.

NODE=M244DM1;LINKAGE=B

NODE=M244DM1;LINKAGE=AA

B₁(5721) WIDTH

NODE=M244210

B₁(5721)⁺ width

NODE=M244W+
NODE=M244W+

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31 ± 6 OUR AVERAGE Error includes scale factor of 1.1.				
29.1 ± 3.6 ± 4.3	8k	AAIJ	15AB LHCB	pp at 7, 8 TeV
49 ⁺¹² ₋₁₀ ⁺² ₋₁₃		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

B₁(5721)⁰ width

NODE=M244W0
NODE=M244W0

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.5 ± 3.4 OUR AVERAGE Error includes scale factor of 1.1.				
30.1 ± 1.5 ± 3.5	35k	AAIJ	15AB LHCB	pp at 7, 8 TeV
23 ± 3 ± 4		AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

B₁(5721) DECAY MODES

NODE=M244215;NODE=M244

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^* \pi$	seen

DESIG=1

$\Gamma(B^* \pi)/\Gamma_{\text{total}}$

Γ_1/Γ

NODE=M244R01
NODE=M244R01

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	AAIJ	15AB LHCB	±0	pp at 7, 8 TeV
seen	AALTONEN	14I CDF	±	$p\bar{p}$ at 1.96 TeV
seen	AALTONEN	09D CDF	0	$p\bar{p}$ at 1.96 TeV
seen	¹ ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV

OCCUR=2

¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$ with $B^{*+} \rightarrow B^+ \gamma$ and $B^+ \rightarrow J/\psi \pi^+$.

NODE=M244R01;LINKAGE=AB

B₁(5721) REFERENCES

NODE=M244

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09D PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	07T PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=56628
REFID=56029
REFID=52700
REFID=52014

$B_J^*(5732)$

$$I(J^P) = ?(?^?)$$

OMITTED FROM SUMMARY TABLE

Signal can be interpreted as stemming from several narrow and broad resonances.

NODE=M151

NODE=M151

NODE=M151M

NODE=M151M

$B_J^*(5732)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
5698± 8 OUR AVERAGE Error includes scale factor of 1.2.				
5710±20		¹ AFFOLDER	01F CDF	$p\bar{p}$ at 1.8 TeV
5695^{+17}_{-19}		² BARATE	98L ALEP	$e^+e^- \rightarrow Z$
5704± 4±10	1944	³ BUSKULIC	96D ALEP	$E_{cm}^{ee} = 88\text{--}94$ GeV
5732± 5±20	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88\text{--}94$ GeV
5681±11	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88\text{--}94$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5713± 2		⁴ ACCIARRI	99N L3	$e^+e^- \rightarrow Z$
¹ AFFOLDER 01F uses the reconstructed B meson through semileptonic decay channels. The fraction of light B mesons that are produced at $L=1$ B^{**} states is measured to be $0.28 \pm 0.06 \pm 0.03$.				
² BARATE 98L uses fully reconstructed B mesons to search for B^{**} production in the $B\pi^\pm$ system. In the framework of heavy quark symmetry (HQS), they also measured the mass of B_2^* to be 5739^{+8+6}_{-11-4} MeV/ c^2 and the relative production rate of $B(b \rightarrow B_2^* \rightarrow B^{(*)}\pi)/B(b \rightarrow B_{u,d}) = (31 \pm 9^{+6}_{-5})\%$.				
³ Using $m_{B\pi} - m_B = 424 \pm 4 \pm 10$ MeV.				
⁴ ACCIARRI 99N uses inclusive reconstructed B mesons to search for B^{**} production in the $B^{(*)}\pi^\pm$ system. In the framework of HQET, they measured the mass of B_1^* and B_2^* to be $5670 \pm 10 \pm 13$ MeV and $5768 \pm 5 \pm 6$ with the $B(b \rightarrow B^{**}) = (32 \pm 3 \pm 6) \times 10^{-2}$. They also reported the evidence for the existence of an excited B -meson state or mixture of states in the region 5.9–6.0 GeV.				

NODE=M151M;LINKAGE=MF

NODE=M151M;LINKAGE=B

NODE=M151M;LINKAGE=A
NODE=M151M;LINKAGE=N

$B_J^*(5732)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
128±18 OUR AVERAGE				
145±28	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88\text{--}94$ GeV
116±24	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88\text{--}94$ GeV

NODE=M151W

NODE=M151W

$B_J^*(5732)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^*\pi + B\pi$	seen
$\Gamma_2 \quad B^*\pi(X)$	[a] (85±29) %
[a] X refers to decay modes with or without additional accompanying decay particles.	

NODE=M151215;NODE=M151

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

LINKAGE=151

$B_J^*(5732)$ BRANCHING RATIOS

X refers to decay modes with or without additional accompanying decay particles.

NODE=M151220

NODE=M151220

$\Gamma(B^*\pi(X))/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.85^{+0.26}_{-0.27} \pm 0.12$	ABBIENDI	02E OPAL	$e^+e^- \rightarrow Z$	

NODE=M151R1
NODE=M151R1

$B_2^*(5732)$ REFERENCES

ABBIENDI	02E	EPJ C23 437	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
AFFOLDER	01F	PR D64 072002	T. Affolder <i>et al.</i>	(CDF Collab.)
ACCIARRI	99N	PL B465 323	M. Acciarri <i>et al.</i>	(L3 Collab.)
BARATE	98L	PL B425 215	R. Barate <i>et al.</i>	(ALEPH Collab.)
BUSKULIC	96D	ZPHY C69 393	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ABREU	95B	PL B345 598	P. Abreu <i>et al.</i>	(DELPHI Collab.)
AKERS	95E	ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)

NODE=M151

REFID=48742
REFID=48369
REFID=47247
REFID=46082
REFID=44677
REFID=44131
REFID=44182

NODE=M245

 $B_2^*(5747)$

$$I(J^P) = \frac{1}{2}(2^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M245

 $B_2^*(5747)$ MASS

NODE=M245205

 $B_2^*(5747)^+$ massOUR FIT uses m_{B^0} and $m_{B_2^{*+}} - m_{B^0}$ to determine $m_{B_2^*(5747)^+}$.

NODE=M245M+

VALUE (MeV)

DOCUMENT ID

5737.3 $\pm$ 0.7 OUR FIT[5737.2 $\pm$ 0.7 MeV OUR 2023 FIT]

NODE=M245M+
NODE=M245M+
NEW

 $m_{B_2^{*+}} - m_{B^0}$

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

457.5 $\pm$ 0.7 OUR FIT**457.5 $\pm$ 0.7 OUR AVERAGE**457.62 $\pm$ 0.72 $\pm$ 0.40

4k

¹ AAIJ15AB LHCB $p\bar{p}$ at 7, 8 TeV457.3 $\pm$ 1.3 $\begin{smallmatrix} +0.3 \\ -0.9 \end{smallmatrix}$ ² AALTONEN14l CDF $p\bar{p}$ at 1.96 TeV

NODE=M245DM+
NODE=M245DM+

¹ AAIJ 15AB reports $[m_{B_2^{*+}} - m_{B^0}] - m_{\pi^+} = 318.1 \pm 0.7 \pm 0.4$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_2^*(5747)^+} - m_{B^0} - m_{\pi^+} = 317.7 \pm 1.2 \begin{smallmatrix} +0.3 \\ -0.9 \end{smallmatrix}$ MeV which we adjusted by the π^+ mass.

NODE=M245DM+;LINKAGE=B

NODE=M245DM+;LINKAGE=A

 $B_2^*(5747)^0$ mass

OUR FIT uses m_{B^+} , $m_{B_1^0} - m_{B^+}$, and mass differences below to determine $m_{B_2^*(5747)^0}$. The -0.659 correlation between statistical uncertainties of $m_{B_1^0} - m_{B^+}$ and $m_{B_2^{*0}} - m_{B_1^0}$ measurements reported by ABAZOV 07T is taken into account.

VALUE (MeV)

DOCUMENT ID

5739.6 $\pm$ 0.7 OUR FITError includes scale factor of 1.4. [5739.5 $\pm$ 0.7 MeV OUR 2023 FIT Scale factor = 1.4]

NODE=M245M0
NEW

 $m_{B_2^{*0}} - m_{B_1^0}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.5 $\pm$ 1.4 OUR FITError includes scale factor of 1.3. [13.4 $\pm$ 1.4 MeV OUR 2023 FIT Scale factor = 1.3]**26.2 $\pm$ 3.1 $\pm$ 0.9**¹ ABAZOV

07T

D0

 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

14.9 $\begin{smallmatrix} +2.2+1.2 \\ -2.5-1.4 \end{smallmatrix}$ ¹ AALTONEN

09D

CDF

Repl. by AALTONEN 14l

¹ Observed in $B_2^{*0} \rightarrow B^{*+} \pi^-$ and $B_2^{*0} \rightarrow B^+ \pi^-$.

NODE=M245DM0;LINKAGE=AB

 $m_{B_2^{*0}} - m_{B^+}$

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

460.2 $\pm$ 0.6 OUR FIT

Error includes scale factor of 1.4.

459.9 $\pm$ 0.8 OUR AVERAGE460.18 $\pm$ 0.37 $\pm$ 0.33

17k

¹ AAIJ15AB LHCB $p\bar{p}$ at 7, 8 TeV457.5 $\pm$ 1.2 $\begin{smallmatrix} +0.8 \\ -0.9 \end{smallmatrix}$ ² AALTONEN

14l

CDF

 $p\bar{p}$ at 1.96 TeV

NODE=M245DM2
NODE=M245DM2

¹ AAIJ 15AB reports $[m_{B_2^{*0}} - m_{B^+}] - m_{\pi^-} = 320.6 \pm 0.4 \pm 0.3$ MeV which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event.

² AALTONEN 14l reports $m_{B_2^*(5747)^0} - m_{B^+} - m_{\pi^-} = 317.9 \pm 1.2 \begin{smallmatrix} +0.8 \\ -0.9 \end{smallmatrix}$ MeV which we adjusted by the π^- mass.

NODE=M245DM2;LINKAGE=A

NODE=M245DM2;LINKAGE=AA

$B_2^*(5747)$ WIDTH

NODE=M245210

 $B_2^*(5747)^+$ width

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
20 ±5 OUR AVERAGE	Error includes scale factor of 2.2.			
23.6±2.0±2.1	4k	AAIJ	15AB LHCB	pp at 7, 8 TeV
11 $\begin{smallmatrix} +4 & +3 \\ -3 & -4 \end{smallmatrix}$		AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

NODE=M245W+
NODE=M245W+ **$B_2^*(5747)^0$ width**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
24.2±1.7 OUR AVERAGE				
24.5±1.0±1.5	17k	AAIJ	15AB LHCB	pp at 7, 8 TeV
22 $\begin{smallmatrix} +3 & +4 \\ -2 & -5 \end{smallmatrix}$		AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22.7 $\begin{smallmatrix} +3.8 & +3.2 \\ -3.2 & -10.2 \end{smallmatrix}$		AALTONEN	09D CDF	Repl. by AALTONEN 14l

NODE=M245W0
NODE=M245W0 **$B_2^*(5747)$ DECAY MODES**

NODE=M245215;NODE=M245

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	seen
Γ_2 $B^*\pi$	seen

DESIG=1

DESIG=2

 $\Gamma(B\pi)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
seen	4k,17k	AAIJ	15AB LHCB	±0	pp at 7, 8 TeV
seen		AALTONEN	14l CDF	±	$p\bar{p}$ at 1.96 TeV
seen		AALTONEN	09D CDF	0	$p\bar{p}$ at 1.96 TeV
seen		ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV

NODE=M245R01
NODE=M245R01 **$\Gamma(B^*\pi)/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
seen	4k,17k	AAIJ	15AB LHCB	±0	pp at 7, 8 TeV
seen		AALTONEN	09D CDF	0	$p\bar{p}$ at 1.96 TeV
seen		ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV

NODE=M245R02
NODE=M245R02 **$\Gamma(B^*\pi)/\Gamma(B\pi)$** **$\Gamma_2/\Gamma_1$**

VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
0.84±0.27 OUR AVERAGE					
0.71±0.14±0.30	17k	AAIJ	15AB LHCB	0	pp at 7, 8 TeV
1.0 ±0.5 ±0.8	4k	AAIJ	15AB LHCB	±	pp at 7, 8 TeV
1.10±0.42±0.31		¹ ABAZOV	07T D0	0	$p\bar{p}$ at 1.96 TeV

NODE=M245R03
NODE=M245R03

¹ Converted from measured ratio of $R = B(B_2^{*0} \rightarrow B^{*+}\pi^-) / B(B_2^{*0} \rightarrow B^{(*)+}\pi^-)$
= 0.475 ± 0.095 ± 0.069.

OCCUR=2

NODE=M245R03;LINKAGE=AB

 $B_2^*(5747)$ REFERENCES

NODE=M245

AAIJ	15AB	JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14l	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AALTONEN	09D	PRL 102 102003	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	07T	PRL 99 172001	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=56628
REFID=56029
REFID=52700
REFID=52014

$B_J(5840)$

$$I(J^P) = \frac{1}{2}(?)$$

I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M246

NODE=M246

NODE=M246205

NODE=M246M+

NODE=M246M+
NODE=M246M+NODE=M246DM+
NODE=M246DM+

OCCUR=2

NODE=M246DM+;LINKAGE=A

NODE=M246DM+;LINKAGE=B

NODE=M246DM1
NODE=M246DM1

NODE=M246DM1;LINKAGE=A

NODE=M246M0

NODE=M246M0
NODE=M246M0NODE=M246DM0
NODE=M246DM0

OCCUR=2

NODE=M246DM0;LINKAGE=A

NODE=M246DM0;LINKAGE=B

 $B_J(5840)$ MASS **$B_J(5840)^+$ MASS**OUR FIT uses m_{B^0} and $m_{B_J(5840)^+} - m_{B^0}$ to determine $m_{B_J(5840)^+}$.

VALUE (MeV)	DOCUMENT ID

5851±19 OUR FIT **$m_{B_J(5840)^+} - m_{B^0}$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

571±19 OUR FIT**571±13±14** 7k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

595±26±14 7k ² AAIJ 15AB LHCb pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 431 \pm 13 \pm 14$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 455 \pm 26 \pm 14$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$m_{B_J(5840)^+} - m_{B^{*0}}$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

565±15±14 7k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^+} = 425 \pm 15 \pm 14$ MeV which we adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$B_J(5840)^0$ MASS**OUR FIT uses m_{B^+} and $m_{B_J(5840)^0} - m_{B^+}$ to determine $m_{B_J(5840)^0}$.

VALUE (MeV)	DOCUMENT ID

5863±9 OUR FIT **$m_{B_J(5840)^0} - m_{B^+}$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

584±9 OUR FIT**584±5±7** 12k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

610±22±7 12k ² AAIJ 15AB LHCb pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 471 \pm 22 \pm 7$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

$m_{B_J(5840)^0} - m_{B^{*+}}$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$584 \pm 5 \pm 7$	12k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV

¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 444 \pm 5 \pm 7$ MeV

which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246DM2
NODE=M246DM2

NODE=M246DM2;LINKAGE=A

 $B_J(5840)$ WIDTH

NODE=M246210

 $B_J(5840)^+$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

220 ± 80 OUR AVERAGE [224 $\pm$ 80 MeV OUR 2023 AVERAGE]

$224 \pm 24 \pm 80$	7k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

215 $\pm$ 27 $\pm$ 80	7k	² AAIJ	15AB LHCB	pp at 7, 8 TeV

229 $\pm$ 27 $\pm$ 80	7k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV

¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246W+
NODE=M246W+
NEW

OCCUR=2
OCCUR=3

NODE=M246W+;LINKAGE=A

NODE=M246W+;LINKAGE=B

NODE=M246W+;LINKAGE=C

 $B_J(5840)^0$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

130 ± 40 OUR AVERAGE [127 $\pm$ 40 MeV OUR 2023 AVERAGE]

$127 \pm 17 \pm 34$	12k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

107 $\pm$ 20 $\pm$ 34	12k	² AAIJ	15AB LHCB	pp at 7, 8 TeV

119 $\pm$ 17 $\pm$ 34	12k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV

¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.

² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.

NODE=M246W0
NODE=M246W0
NEW

OCCUR=2
OCCUR=3

NODE=M246W0;LINKAGE=A

NODE=M246W0;LINKAGE=B

NODE=M246W0;LINKAGE=C

 $B_J(5840)$ DECAY MODES

NODE=M246215;NODE=M246

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^* \pi$	seen
Γ_2 $B \pi$	possibly seen

DESIG=1

DESIG=2

 $B_J(5840)$ BRANCHING RATIOS

NODE=M246220

$\Gamma(B^*\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
seen	7k	AAIJ	15AB LHCB	$\pm$	pp at 7, 8 TeV
seen	12k	AAIJ	15AB LHCB	0	pp at 7, 8 TeV

NODE=M246R01
NODE=M246R01

OCCUR=2

$\Gamma(B\pi)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
possibly seen	7k	¹ AAIJ	15AB LHCB	$\pm$	pp at 7, 8 TeV
possibly seen		¹ AAIJ	15AB LHCB	0	pp at 7, 8 TeV

NODE=M246R02
NODE=M246R02

OCCUR=2

¹ A $B \pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^* \pi$ is allowed.

NODE=M246R02;LINKAGE=A

 $B_J(5840)$ REFERENCES

NODE=M246

AAIJ	15AB JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=56628

$B_J(5970)$

$$I(J^P) = \frac{1}{2}(??)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M248

NODE=M248

NODE=M248205

NODE=M248M+

NODE=M248M+

NODE=M248M+

NEW

NODE=M248DM+

NODE=M248DM+

OCCUR=2

NODE=M248DM+;LINKAGE=B

NODE=M248DM+;LINKAGE=A

NODE=M248DM+;LINKAGE=C

NODE=M248DM1

NODE=M248DM1

NODE=M248DM1;LINKAGE=A

NODE=M248M0

NODE=M248M0

NODE=M248M0

NODE=M248DM0

NODE=M248DM0

OCCUR=2

NODE=M248DM0;LINKAGE=B

NODE=M248DM0;LINKAGE=A

NODE=M248DM0;LINKAGE=C

 $B_J(5970)$ MASS **$B_J(5970)^+$ MASS**OUR FIT uses m_{B^0} and $m_{B_J(5970)^+} - m_{B^0}$ to determine $m_{B_J(5970)^+}$.

VALUE (MeV)

DOCUMENT ID

5965 ± 5 OUR FIT

[5964 ± 5 MeV OUR 2023 FIT]

 $m_{B_J(5970)^+} - m_{B^0}$

VALUE (MeV)

EVTs

DOCUMENT ID

TECN

COMMENT

685 ± 5 OUR FIT**685 ± 5 OUR AVERAGE**

685.3 ± 4.1 ± 2.5

2k

¹ AAIJ

15AB LHCb

 pp at 7, 8 TeV

681 ± 5 ± 12

1.4k

² AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

686.8 ± 4.5 ± 2.5

2k

³ AAIJ

15AB LHCb

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 545.8 \pm 4.1 \pm 2.5$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AALTONEN 14l reports $m_{B_J(5970)^+} - m_{B^0} - m_{\pi^+} = 541 \pm 5 \pm 12$ MeV which we adjusted by the π^+ mass.³ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - m_{\pi^+} = 547 \pm 5 \pm 3$ MeV which we adjust bythe π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$m_{B_J(5970)^+} - m_{B^{*0}}$**

VALUE (MeV)

EVTs

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

686.0 ± 4.0 ± 2.5

2k

¹ AAIJ

15AB LHCb

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^+} - m_{B^0}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^+} = 547 \pm 4 \pm 3$ MeV whichwe adjust by the π^+ mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*0}} - m_{B^0}) = (m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference. **$B_J(5970)^0$ MASS**OUR FIT uses m_{B^+} and $m_{B_J(5970)^0} - m_{B^+}$ to determine $m_{B_J(5970)^0}$.

VALUE (MeV)

DOCUMENT ID

5971 ± 5 OUR FIT **$m_{B_J(5970)^0} - m_{B^+}$**

VALUE (MeV)

EVTs

DOCUMENT ID

TECN

COMMENT

691 ± 5 OUR FIT**691 ± 5 OUR AVERAGE**

689.9 ± 2.9 ± 5.1

10k

¹ AAIJ

15AB LHCb

 pp at 7, 8 TeV

698 ± 5 ± 12

2.6k

² AALTONEN

14l CDF

 $p\bar{p}$ at 1.96 TeV

• • • We do not use the following data for averages, fits, limits, etc. • • •

714.3 ± 6.4 ± 5.1

10k

³ AAIJ

15AB LHCb

 pp at 7, 8 TeV¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 550.4 \pm 2.9 \pm 5.1$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses two relativistic Breit-Wigner functions in the fit for mass difference.² AALTONEN 14l reports $m_{B_J(5970)^0} - m_{B^+} - m_{\pi^-} = 558 \pm 5 \pm 12$ MeV which we adjusted by the π^- mass.³ AAIJ 15AB reports $[m_{B_J^0} - m_{B^+}] - m_{\pi^-} = 575 \pm 6 \pm 5$ MeV which we adjust bythe π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = (-1)^J$ and uses three relativistic Breit-Wigner functions in the fit for mass difference.

$m_{B_J(5970)^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$691.6 \pm 3.7 \pm 5.1$	10k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
¹ AAIJ 15AB reports $[m_{B_J^0} - m_{B^{*+}}] - (m_{B^{*+}} - m_{B^+}) - m_{\pi^-} = 552 \pm 4 \pm 5$ MeV				
which we adjust by the π^- mass. The masses inside the square brackets were measured for each candidate event. The result assumes $P = -(-1)^J$, $(m_{B^{*+}} - m_{B^+}) = 45.01 \pm 0.30 \pm 0.23$ MeV, and uses three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M248DM2
NODE=M248DM2

NODE=M248DM2;LINKAGE=A

 $B_J(5970)$ WIDTH $B_J(5970)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
62±20 OUR AVERAGE				
$63 \pm 15 \pm 17$	2k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
$60^{+30}_{-20} \pm 40$	1.4k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$61 \pm 14 \pm 17$	2k	² AAIJ	15AB LHCB	pp at 7, 8 TeV
$61 \pm 15 \pm 17$	2k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV
¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.				
² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				
³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M248210

NODE=M248W+
NODE=M248W+

OCCUR=2
OCCUR=3

NODE=M248W+;LINKAGE=A

NODE=M248W+;LINKAGE=B

NODE=M248W+;LINKAGE=C

 $B_J(5970)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
81±12 OUR AVERAGE				
$82 \pm 8 \pm 9$	10k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
$70^{+30}_{-20} \pm 30$	2.6k	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$56 \pm 7 \pm 9$	10k	² AAIJ	15AB LHCB	pp at 7, 8 TeV
$82 \pm 10 \pm 9$	10k	³ AAIJ	15AB LHCB	pp at 7, 8 TeV
¹ Assuming $P = (-1)^J$ and using two relativistic Breit-Wigner functions in the fit for mass difference.				
² Assuming $P = (-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				
³ Assuming $P = -(-1)^J$ and using three relativistic Breit-Wigner functions in the fit for mass difference.				

NODE=M248W0
NODE=M248W0

OCCUR=2
OCCUR=3

NODE=M248W0;LINKAGE=A

NODE=M248W0;LINKAGE=B

NODE=M248W0;LINKAGE=C

 $B_J(5970)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	possibly seen
Γ_2 $B^*\pi$	seen

NODE=M248215;NODE=M248

DESIG=1
DESIG=2

 $B_J(5970)$ BRANCHING RATIOS

$\Gamma(B\pi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
possibly seen	2k	¹ AAIJ	15AB LHCB	$\pm$	pp at 7, 8 TeV	
possibly seen	10k	¹ AAIJ	15AB LHCB	0	pp at 7, 8 TeV	
possibly seen	2.6k	AALTONEN	14I CDF	0	$p\bar{p}$ at 1.96 TeV	
possibly seen	1.4k	AALTONEN	14I CDF	$\pm$	$p\bar{p}$ at 1.96 TeV	
¹ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.						
$\Gamma(B^*\pi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2/Γ
seen	10k	AAIJ	15AB LHCB	0	pp at 7, 8 TeV	
seen	2k	AAIJ	15AB LHCB	$\pm$	pp at 7, 8 TeV	
seen	2.6k	AALTONEN	14I CDF	0	$p\bar{p}$ at 1.96 TeV	
seen	1.4k	AALTONEN	14I CDF	$\pm$	$p\bar{p}$ at 1.96 TeV	

NODE=M248220

NODE=M248R01
NODE=M248R01

OCCUR=2

OCCUR=2

NODE=M248R01;LINKAGE=A

NODE=M248R02
NODE=M248R02

OCCUR=2

OCCUR=2

 $B_J(5970)$ REFERENCES

AAIJ	15AB	JHEP 1504 024	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	14I	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M248

REFID=56628
REFID=56029

BOTTOM, STRANGE MESONS

($B = \pm 1, S = \mp 1$)

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \text{ similarly for } B_s^{*\prime}s$$

$B_{s1}(5830)^0$

$$I(J^P) = 0(1^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

$B_{s1}(5830)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5828.73$\pm$0.20 OUR FIT			
[5828.70 $\pm$ 0.20 MeV OUR 2023 FIT]			
5828.65$\pm$0.24 OUR AVERAGE			
5828.78 $\pm$ 0.09 $\pm$ 0.29	SIRUNYAN	18DF CMS	pp at 8 TeV
5828.40 $\pm$ 0.04 $\pm$ 0.41	¹ AAIJ	130 LHCb	pp at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5829.4 $\pm$ 0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ Uses $B_{s1}(5830)^0 \rightarrow B^{*+} K^-$ decay.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

$$m_{B_{s1}^0} - m_{B^{*+}}$$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
503.98$\pm$0.17 OUR FIT			
[503.99 $\pm$ 0.17 MeV OUR 2023 FIT]			
504.03$\pm$0.12$\pm$0.15	¹ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
504.41 $\pm$ 0.21 $\pm$ 0.14	² AALTONEN	08K CDF	Repl. by AALTONEN 14I
¹ AALTONEN 14I reports $m_{B_{s1}(5830)^0} - m_{B^{*+}} - m_{K^-} = 10.35 \pm 0.12 \pm 0.15$ MeV which we adjusted by the K^- mass.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

$B_{s1}(5830)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
0.5$\pm$0.3$\pm$0.3	AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

$B_{s1}(5830)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*+} K^-$	seen
Γ_2 $B^{*0} K_S^0$	

$B_{s1}(5830)^0$ BRANCHING RATIOS

$\Gamma(B^{*+} K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AALTONEN	08K CDF	$p\bar{p}$ at 1.96 TeV
$\Gamma(B^{*0} K_S^0)/\Gamma(B^{*+} K^-)$	Γ_2/Γ_1		
VALUE	DOCUMENT ID	TECN	COMMENT
$0.49 \pm 0.12 \pm 0.07$	¹ SIRUNYAN	18DF CMS	pp at 8 TeV
¹ With the branching fractions $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$ and $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.			

NODE=MXXX046

NODE=MXXX046

NODE=M187

NODE=M187

NODE=M187M

NODE=M187M
NEW

NODE=M187M;LINKAGE=AI
NODE=M187M;LINKAGE=AA

NODE=M187DM

NODE=M187DM
NEW

NODE=M187DM;LINKAGE=AL

NODE=M187DM;LINKAGE=AA

NODE=M187W

NODE=M187W

NODE=M187215;NODE=M187

DESIG=1

DESIG=2

NODE=M187220

NODE=M187R01
NODE=M187R01

NODE=M187R00
NODE=M187R00

NODE=M187R00;LINKAGE=A

$B_{s1}(5830)^0$ REFERENCES

SIRUNYAN	18DF	EPJ C78 939	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AALTONEN	14l	PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	13O	PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	08K	PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M187

REFID=59328
REFID=56029
REFID=54968
REFID=52235

 $B_{s2}^*(5840)^0$

$I(J^P) = 0(2^+)$
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M186

NODE=M186

 $B_{s2}^*(5840)^0$ MASS

NODE=M186M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5839.88$\pm$0.12 OUR FIT			
[5839.86 $\pm$ 0.12 MeV OUR 2023 FIT]			
5839.92$\pm$0.14 OUR AVERAGE			
5839.86 $\pm$ 0.09 $\pm$ 0.17	SIRUNYAN	18DF CMS	pp at 8 TeV
5839.99 $\pm$ 0.05 $\pm$ 0.20	AAIJ	13O LHCb	pp at 7 TeV
5839.6 $\pm$ 1.1 $\pm$ 0.7	¹ ABAZOV	08E D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5839.7 $\pm$ 0.7	² AALTONEN	08K CDF	Repl. by AALTONEN 14l
¹ Observed in $B_{s2}^{*0} \rightarrow B^+ K^-$. Measured production rate of B_{s2}^{*0} relative to B^+ to be (1.15 $\pm$ 0.23 $\pm$ 0.13)%.			
² Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M186M

NEW

NODE=M186M;LINKAGE=AB

NODE=M186M;LINKAGE=AA

 $m_{B_{s2}^{*0}} - m_{B_{s1}^0}$

NODE=M186DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5 $\pm$ 0.6	¹ AALTONEN	08K CDF	Repl. by AALTONEN 14l
¹ Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			
$m_{B_{s2}^{*0}} - m_{B^+}$			

NODE=M186DM

NODE=M186DM;LINKAGE=AA

NODE=M186DM2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
560.48$\pm$0.12 OUR FIT			
[560.52 $\pm$ 0.14 MeV OUR 2023 FIT]			
560.41$\pm$0.13$\pm$0.14	¹ AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV
¹ AALTONEN 14l reports $m_{B_{s2}(5840)^0} - m_{B^+} - m_{K^-} = 66.73 \pm 0.13 \pm 0.14$ MeV which we adjusted by the K^- mass.			

NODE=M186DM2

NEW

NODE=M186DM2;LINKAGE=AL

 $B_{s2}^*(5840)^0$ WIDTH

NODE=M186W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1.49$\pm$0.27 OUR AVERAGE			
1.52 $\pm$ 0.34 $\pm$ 0.30	SIRUNYAN	18DF CMS	pp at 8 TeV
1.4 $\pm$ 0.4 $\pm$ 0.2	AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV
1.56 $\pm$ 0.13 $\pm$ 0.47	¹ AAIJ	13O LHCb	pp at 7 TeV
¹ Uses $B_{s2}^*(5840)^0 \rightarrow B^{*+} K^-$ decays.			

NODE=M186W

NODE=M186W;LINKAGE=AI

 $B_{s2}^*(5840)^0$ DECAY MODES

NODE=M186215;NODE=M186

Branching fractions are given relative to the one **DEFINED AS 1**.

NODE=M186

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+ K^-$	DEFINED AS 1
Γ_2 $B^{*+} K^-$	0.093 $\pm$ 0.018
Γ_3 $B^0 K_S^0$	0.43 $\pm$ 0.11
Γ_4 $B^{*0} K_S^0$	0.04 $\pm$ 0.04

DESIG=1

DESIG=2

DESIG=4

DESIG=3

$B_{s2}^*(5840)^0$ BRANCHING RATIOS

$\Gamma(B^+K^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AALTONEN	08K CDF	$p\bar{p}$ at 1.96 TeV	
seen	¹ ABAZOV	08E D0	$p\bar{p}$ at 1.96 TeV	
¹ Measured production rate of B_{s2}^{*0} relative to B^+ to be $(1.15 \pm 0.23 \pm 0.13)\%$.				

NODE=M186220

NODE=M186R01
NODE=M186R01

NODE=M186R01;LINKAGE=AB

$\Gamma(B^{*+}K^-)/\Gamma(B^+K^-)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.093±0.013±0.012	AAIJ	130 LHCB	pp at 7 TeV	

NODE=M186R02
NODE=M186R02

$\Gamma(B^{*0}K_S^0)/\Gamma(B^0K_S^0)$				Γ_4/Γ_3
VALUE	DOCUMENT ID	TECN	COMMENT	
0.093±0.086±0.014	¹ SIRUNYAN	18DF CMS	pp at 8 TeV	
¹ With the branching fraction $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.				

NODE=M186R00
NODE=M186R00

NODE=M186R00;LINKAGE=A

$\Gamma(B^0K_S^0)/\Gamma(B^+K^-)$				Γ_3/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.432±0.077±0.078	¹ SIRUNYAN	18DF CMS	pp at 8 TeV	
¹ With the branching fractions $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$ and $B(B^0 \rightarrow J/\psi K^{*0}) = (1.28 \pm 0.05) \times 10^{-3}$.				

NODE=M186R03
NODE=M186R03

NODE=M186R03;LINKAGE=A

$\Gamma(B^{*+}K^-)/\Gamma(B^+K^-)$				Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT	
0.081±0.021±0.015	¹ SIRUNYAN	18DF CMS	pp at 8 TeV	
¹ With the branching fraction $B(B^+ \rightarrow J/\psi K^+) = (1.026 \pm 0.031) \times 10^{-3}$.				

NODE=M186R04
NODE=M186R04

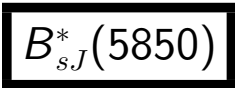
NODE=M186R04;LINKAGE=A

$B_{s2}^*(5840)^0$ REFERENCES

SIRUNYAN	18DF EPJ C78 939	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AALTONEN	14I PR D90 012013	T. Aaltonen <i>et al.</i>	(CDF Collab.)
AAIJ	130 PRL 110 151803	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	08K PRL 100 082001	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	08E PRL 100 082002	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M186

REFID=59328
REFID=56029
REFID=54968
REFID=52235
REFID=52232



$I(J^P) = ?(??)$

OMITTED FROM SUMMARY TABLE

Signal can be interpreted as coming from $\bar{b}s$ states. Needs confirmation.

NODE=M153

NODE=M153

$B_{sJ}^*(5850)$ MASS

NODE=M153M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5853±15	141	AKERS	95E OPAL	$E_{\text{cm}}^{\text{ee}} = 88\text{--}94$ GeV

NODE=M153M

$B_{sJ}^*(5850)$ WIDTH

NODE=M153W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
47±22	141	AKERS	95E OPAL	$E_{\text{cm}}^{\text{ee}} = 88\text{--}94$ GeV

NODE=M153W

$B_{sJ}^*(5850)$ REFERENCES

NODE=M153

AKERS	95E ZPHY C66 19	R. Akers <i>et al.</i>	(OPAL Collab.)

REFID=44182

NODE=M257

$B_{sJ}(6063)^0$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE

$B_{sJ}(6063)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$6063.5 \pm 1.2 \pm 0.8$	¹ AAIJ	21D LHCb	pp at 7, 8, 13 TeV
¹ Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb ⁻¹ .			

NODE=M257M

NODE=M257M

NODE=M257M;LINKAGE=A

$B_{sJ}(6063)^0$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$26 \pm 4 \pm 4$	¹ AAIJ	21D LHCb	pp at 7, 8, 13 TeV
¹ Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb ⁻¹ .			

NODE=M257W

NODE=M257W

NODE=M257W;LINKAGE=A

$B_{sJ}(6063)^0$ DECAY MODES

NODE=M257215;NODE=M257

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^+ K^-$	seen

DESIG=1

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	21D LHCb	$B^\pm K^\mp$ mass spectrum

NODE=M257R01
NODE=M257R01

$B_{sJ}(6063)^0$ REFERENCES

NODE=M257

AAIJ	21D	EPJ C81 601	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=61130

NODE=M258

$B_{sJ}(6114)^0$

$$I(J^P) = 0(?)^?$$

OMITTED FROM SUMMARY TABLE

$B_{sJ}(6114)^0$ MASS

NODE=M258M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$6114 \pm 3 \pm 5$	¹ AAIJ	21D LHCb	pp at 7, 8, 13 TeV
¹ Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb ⁻¹ .			

NODE=M258M

NODE=M258M;LINKAGE=A

$B_{sJ}(6114)^0$ WIDTH

NODE=M258W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$66 \pm 18 \pm 21$	¹ AAIJ	21D LHCb	pp at 7, 8, 13 TeV
¹ Seen in the decay channel $B^\pm K^\mp$. Integrated luminosity = 9 fb ⁻¹ .			

NODE=M258W

NODE=M258W;LINKAGE=B

$B_{sJ}(6114)^0$ DECAY MODES

NODE=M258215;NODE=M258

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B^+ K^-$	seen

DESIG=1

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	21D LHCb	$B^\pm K^\mp$ mass spectrum

NODE=M258R01
NODE=M258R01

$B_{sJ}(6114)^0$ REFERENCES

NODE=M258

AAIJ	21D	EPJ C81 601	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=61130

BOTTOM, CHARMED MESONS

($B = C = \pm 1$)

$$B_c^+ = c\bar{b}, B_c^- = \bar{c}b, \quad \text{similarly for } B_c^{*'}s$$

$$B_c(2S)^\pm$$

$$I(J^P) = 0(0^-)$$

Quantum numbers neither measured nor confirmed.

$B_c(2S)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
6871.2$\pm$1.0 OUR AVERAGE				
6871.7 $\pm$ 1.3 $\pm$ 0.3	24	^{1,2} AAIJ	19Y LHCb	pp at 7, 8, 13 TeV
6870.6 $\pm$ 1.4 $\pm$ 0.3	51	^{3,4} SIRUNYAN	19M CMS	pp at 13 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		⁵ AAIJ	18AL LHCb	pp at 8 TeV
6842 ± 4 ± 5	57	^{6,7} AAD	14AQ ATLAS	pp at 7, 8 TeV

¹ AAIJ 19Y observed $B_c(2S)^+$ in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 2.2 (3.2) global (local) standard deviations significance.

² AAIJ 19Y reports mass difference measurement of $M(B_c(2S)^+) - M(B_c^+) = 597.2 \pm 1.3 \pm 0.1$ MeV. We have adjusted this measurement with our best value of $M(B_c^+) = 6274.47 \pm 0.32$ MeV. The first uncertainty of the $M(B_c(2S)^+)$ value is a total of uncertainties reported by the experiment and the second one comes from our best value of $M(B_c^+)$.

³ SIRUNYAN 19M observed $B_c(2S)^+$ in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 6.5 standard deviations significance.

⁴ SIRUNYAN 19M reports mass difference measurement of $M(B_c(2S)^+) - M(B_c^+) = 596.1 \pm 1.2 \pm 0.8$ MeV. We have adjusted this measurement with our best value of $M(B_c^+) = 6274.47 \pm 0.32$ MeV. The first uncertainty of the $M(B_c(2S)^+)$ value is a total of uncertainties reported by the experiment and the second one comes from our best value of $M(B_c^+)$.

⁵ AAIJ 18AL reports an upper limit on the ratio of production cross sections for $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04-0.09$ at 95% CL for the mass value reported by AAD 14AQ.

⁶ Observed in the decay mode $B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-$ ($B_c^+ \rightarrow J/\psi \pi^+$) with 5.2 standard deviations significance.

⁷ Might be the $B_c^*(2S)$.

$B_c(2S)^\pm$ DECAY MODES $\times B(\bar{b} \rightarrow B_c(2S))$

The following quantities are not pure branching ratios; rather the fractions $\Gamma_i/\Gamma \times B(\bar{b} \rightarrow B_c(2S))$.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B_c^+ \pi^+ \pi^-$	seen

$B_c(2S)^\pm$ BRANCHING RATIOS

$\Gamma(B_c^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen		SIRUNYAN	19M CMS	pp at 13 TeV	
seen	57	¹ AAD	14AQ ATLS	pp at 7, 8 TeV	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
not seen		² AAIJ	18AL LHCb	pp at 8 TeV	

¹ Observed with 5.2 standard deviations significance.

² AAIJ 18AL reports an upper limit on the ratio of production cross sections for $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04-0.09$ at 95% CL for the mass value reported by AAD 14AQ.

NODE=MXXX049

NODE=MXXX049

NODE=M217

NODE=M217

NODE=M217M

NODE=M217M

SYCLP=A

SYCLP=A

NODE=M217M;LINKAGE=E

NODE=M217M;LINKAGE=F

NODE=M217M;LINKAGE=B

NODE=M217M;LINKAGE=D

NODE=M217M;LINKAGE=A

NODE=M217M;LINKAGE=AA

NODE=M217M;LINKAGE=C

NODE=M217215;NODE=M217

NODE=M217

DESIG=1

NODE=M217225

NODE=M217R01

NODE=M217R01

NODE=M217R01;LINKAGE=AA

NODE=M217R01;LINKAGE=A

$\eta_c(1S)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

NODE=M026

 $\eta_c(1S)$ MASS

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2984.1 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2. [2983.9 ± 0.4 MeV OUR 2023 AVERAGE Scale factor = 1.2]		
2985.01 ± 0.17 ± 0.89	35k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
2983.9 ± 0.7 ± 0.1		¹ AAIJ	20H LHCB	$pp \rightarrow bX \rightarrow p\bar{p}X$
2985.9 ± 0.7 ± 2.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma\omega\omega$
2984.6 ± 0.7 ± 2.2	2673	XU	18 BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
2986.7 ± 0.5 ± 0.9	11k	² AAIJ	17AD LHCB	$pp \rightarrow B^+X \rightarrow p\bar{p}K^+X$
2982.8 ± 1.0 ± 0.5	6.4k	³ AAIJ	17BB LHCB	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
2982.2 ± 1.5 ± 0.1	2.0k	⁴ AAIJ	15BI LHCB	$pp \rightarrow \eta_c(1S)X$
2983.5 ± 1.4 ± 1.6		⁵ ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma\eta_c$
2979.8 ± 0.8 ± 3.5	4.5k	^{6,7} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
2984.1 ± 1.1 ± 2.1	900	^{6,7,8} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
2984.3 ± 0.6 ± 0.6		^{9,10} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma\eta_c$
2984.49 ± 1.16 ± 0.52	832	⁶ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma \text{ hadrons}$
2982.7 ± 1.8 ± 2.2	486	ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
2984.5 ± 0.8 ± 3.1	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
2985.4 ± 1.5 ± 0.5	920	¹⁰ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$
2982.2 ± 0.4 ± 1.6	14k	¹¹ LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^-K_S^0 K^\pm \pi^\mp$
2985.8 ± 1.5 ± 3.1	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S)K^(*) \rightarrow K\bar{K}\pi K^(*)$
2986.1 ± 1.0 ± 2.5	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow \text{hadrons}$
2970 ± 5 ± 6	501	¹² ABE	07 BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$
2971 ± 3 ± 2	195	WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+$
2974 ± 7 ± 2	20	WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
2981.8 ± 1.3 ± 1.5	592	ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c' \rightarrow K_S^0 K^\pm \pi^\mp$
2984.1 ± 2.1 ± 1.0	190	¹³ AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2982.5 ± 0.4 ± 1.4	12k	¹⁴ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
2982.2 ± 0.6		¹⁵ MITCHELL	09 CLEO	$e^+e^- \rightarrow \gamma X$
2982 ± 5	270	¹⁶ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
2982.5 ± 1.1 ± 0.9	2.5k	¹⁷ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$
2977.5 ± 1.0 ± 1.2		^{15,18} BAI	03 BES	$J/\psi \rightarrow \gamma\eta_c$
2979.6 ± 2.3 ± 1.6	180	¹⁹ FANG	03 BELL	$B \rightarrow \eta_c K$
2976.3 ± 2.3 ± 1.2		^{15,20} BAI	00F BES	$J/\psi, \psi(2S) \rightarrow \gamma\eta_c$
2976.6 ± 2.9 ± 1.3	140	^{15,21} BAI	00F BES	$J/\psi \rightarrow \gamma\eta_c$
2980.4 ± 2.3 ± 0.6		²² BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
2975.8 ± 3.9 ± 1.2		²¹ BAI	99B BES	Sup. by BAI 00F
2999 ± 8	25	ABREU	98O DLPH	$e^+e^- \rightarrow e^+e^- + \text{hadrons}$
2988.3 ± 3.3		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
2974.4 ± 1.9		^{15,23} BISELLO	91 DM2	$J/\psi \rightarrow \eta_c \gamma$
2969 ± 4 ± 4	80	¹⁵ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2956 ± 12 ± 12		¹⁵ BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
2982.6 ± 2.7	12	BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
2980.2 ± 1.6		^{15,23} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026M

NEW

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

2984	$\pm 2.3 \pm 4.0$	15	GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
2976	± 8	15,24	BALTRUSAIT..84	MRK3		$J/\psi \rightarrow 2\phi\gamma$
2982	± 8	18	25 HIMEL	80B	MRK2	e^+e^-
2980	± 9	25	PARTRIDGE	80B	CBAL	e^+e^-
1 AAIJ 20H report $m_{J/\psi} - m_{\eta_c(1S)} = 113.0 \pm 0.7 \pm 0.1$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.						
2 AAIJ 17AD report $m_{J/\psi} - m_{\eta_c(1S)} = 110.2 \pm 0.5 \pm 0.9$ MeV. We use the current value $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to obtain the quoted mass.						
3 From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.						
4 AAIJ 15BI reports $m_{J/\psi} - m_{\eta_c(1S)} = 114.7 \pm 1.5 \pm 0.1$ MeV from a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays. We have used current value of $m_{J/\psi} = 3096.900 \pm 0.006$ MeV to arrive at the quoted $m_{\eta_c(1S)}$ result.						
5 Taking into account an asymmetric photon lineshape.						
6 With floating width.						
7 Ignoring possible interference with the non-resonant 0^- amplitude.						
8 Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decays.						
9 From a simultaneous fit to six decay modes of the η_c .						
10 Accounts for interference with non-resonant continuum.						
11 Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.						
12 From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.						
13 Using mass of $\psi(2S) = 3686.00$ MeV.						
14 Not independent from the measurements reported by LEES 10.						
15 MITCHELL 09 observes a significant asymmetry in the lineshapes of $\psi(2S) \rightarrow \gamma\eta_c$ and $J/\psi \rightarrow \gamma\eta_c$ transitions. If ignored, this asymmetry could lead to significant bias whenever the mass and width are measured in $\psi(2S)$ or J/ψ radiative decays.						
16 From the fit of the kaon momentum spectrum. Systematic errors not evaluated.						
17 Superseded by LEES 10.						
18 From a simultaneous fit of five decay modes of the η_c .						
19 Superseded by VINOKUROVA 11.						
20 Weighted average of the $\psi(2S)$ and $J/\psi(1S)$ samples. Using an η_c width of 13.2 MeV.						
21 Average of several decay modes. Using an η_c width of 13.2 MeV.						
22 Superseded by ASNER 04.						
23 Average of several decay modes.						
24 $\eta_c \rightarrow \phi\phi$.						
25 Mass adjusted by us to correspond to $J/\psi(1S)$ mass = 3097 MeV.						

NODE=M026M;LINKAGE=H

NODE=M026M;LINKAGE=F

NODE=M026M;LINKAGE=G

NODE=M026M;LINKAGE=D

NODE=M026M;LINKAGE=E

NODE=M026M;LINKAGE=AL

NODE=M026M;LINKAGE=LS

NODE=M026M;LINKAGE=EL

NODE=M026M;LINKAGE=BL

NODE=M026M;LINKAGE=VA

NODE=M026M;LINKAGE=LE

NODE=M026M;LINKAGE=EB

NODE=M026M;LINKAGE=BG

NODE=M026M;LINKAGE=DE

NODE=M026M;LINKAGE=MI

NODE=M026M;LINKAGE=AU

NODE=M026M;LINKAGE=UB

NODE=M026M;LINKAGE=AK

NODE=M026M;LINKAGE=FA

NODE=M026M;LINKAGE=KZ

NODE=M026M;LINKAGE=C1

NODE=M026M;LINKAGE=NN

NODE=M026M;LINKAGE=A

NODE=M026M;LINKAGE=B

NODE=M026M;LINKAGE=M

 $\eta_c(1S)$ WIDTH

NODE=M026W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
30.5$\pm$ 0.5 OUR FIT	Error includes scale factor of 1.2. [32.0 $\pm$ 0.7 MeV OUR 2023 FIT]			
30.5$\pm$ 0.5 OUR AVERAGE	Error includes scale factor of 1.1. [32.1 $\pm$ 0.8 MeV OUR 2023 AVERAGE Scale factor = 1.1]			
29.7 $\pm$ 0.5 $\pm$ 0.2	35k	AAIJ	23AH LHCb	$B^+ \rightarrow K^+(K_S^0 K \pi)$
33.8 $\pm$ 1.6 $\pm$ 4.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma\omega\omega$
30.8 $^{+2.3}_{-2.2}$ $\pm$ 2.9	2673	XU	18 BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
34.0 $\pm$ 1.9 $\pm$ 1.3	11k	AAIJ	17AD LHCb	$p\bar{p} \rightarrow B^+X \rightarrow p\bar{p}K^+X$
31.4 $\pm$ 3.5 $\pm$ 2.0	6.4k	1 AAIJ	17BB LHCb	$p\bar{p} \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
27.2 $\pm$ 3.1 $^{+5.4}_{-2.6}$		2 ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma\eta_c$
25.2 $\pm$ 2.6 $\pm$ 2.4	4.5k	3,4 LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
34.8 $\pm$ 3.1 $\pm$ 4.0	900	3,4,5 LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
32.0 $\pm$ 1.2 $\pm$ 1.0		6,7 ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma\eta_c$
36.4 $\pm$ 3.2 $\pm$ 1.7	832	3 ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma$ hadrons
37.8 $^{+5.8}_{-5.3}$ $\pm$ 3.1	486	ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
36.2 $\pm$ 2.8 $\pm$ 3.0	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
35.1 $\pm$ 3.1 $^{+1.0}_{-1.6}$	920	7 VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm\pi^\mp)$
31.7 $\pm$ 1.2 $\pm$ 0.8	14k	8 LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^-K_S^0 K^\pm\pi^\mp$
36.3 $^{+3.7}_{-3.6}$ $\pm$ 4.4	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S)K(*) \rightarrow K\bar{K}\pi K(*)$
28.1 $\pm$ 3.2 $\pm$ 2.2	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
48 $^{+8}_{-7}$ $\pm$ 5	195	WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+$

NODE=M026W

NEW

NEW

OCCUR=2

40 ±19 ±5	20	WU	06	BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$	OCCUR=2
24.8 ± 3.4 ± 3.5	592	ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$	
20.4 $^{+7.7}_{-6.7}$ ± 2.0	190	AMBROGIANI	03	E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$	
23.9 $^{+12.6}_{-7.1}$		ARMSTRONG	95F	E760	$\bar{p}p \rightarrow \gamma\gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

32.1 ± 1.1 ± 1.3	12k	⁹ DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	OCCUR=2
34.3 ± 2.3 ± 0.9	2.5k	¹⁰ AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
17.0 ± 3.7 ± 7.4		¹¹ BAI	03	BES	$J/\psi \rightarrow \gamma \eta_c$
29 ± 8 ± 6	180	¹² FANG	03	BELL	$B \rightarrow \eta_c K$
11.0 ± 8.1 ± 4.1		¹³ BAI	00F	BES	$J/\psi \rightarrow \gamma \eta_c$ and $\psi(2S) \rightarrow \gamma \eta_c$
27.0 ± 5.8 ± 1.4		¹⁴ BRANDENB...	00B	CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
7.0 $^{+7.5}_{-7.0}$	12	BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma$
10.1 $^{+33.0}_{-8.2}$	23	¹⁵ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma p \bar{p}$	
11.5 ± 4.5		GAISER	86	CBAL	$J/\psi \rightarrow \gamma X, \psi(2S) \rightarrow \gamma X$
< 40 90% CL	18	HIMEL	80B	MRK2	$e^+ e^-$
< 20 90% CL		PARTRIDGE	80B	CBAL	$e^+ e^-$

¹ From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.

² Taking into account an asymmetric photon lineshape.

³ With floating mass.

⁴ Ignoring possible interference with the non-resonant 0^- amplitude.

⁵ Using both, $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁶ From a simultaneous fit to six decay modes of the η_c .

⁷ Accounts for interference with non-resonant continuum.

⁸ Taking into account interference with the non-resonant $J^P = 0^-$ amplitude.

⁹ Not independent from the measurements reported by LEES 10.

¹⁰ Superseded by LEES 10.

¹¹ From a simultaneous fit of five decay modes of the η_c .

¹² Superseded by VINOKUROVA 11.

¹³ From a fit to the 4-prong invariant mass in $\psi(2S) \rightarrow \gamma \eta_c$ and $J/\psi(1S) \rightarrow \gamma \eta_c$ decays.

¹⁴ Superseded by ASNER 04.

¹⁵ Positive and negative errors correspond to 90% confidence level.

NODE=M026W;LINKAGE=B
 NODE=M026W;LINKAGE=A
 NODE=M026W;LINKAGE=AL
 NODE=M026W;LINKAGE=LS
 NODE=M026W;LINKAGE=EL
 NODE=M026W;LINKAGE=BL
 NODE=M026W;LINKAGE=VA
 NODE=M026W;LINKAGE=LE
 NODE=M026W;LINKAGE=DE
 NODE=M026W;LINKAGE=UB
 NODE=M026W;LINKAGE=AK
 NODE=M026W;LINKAGE=FA
 NODE=M026W;LINKAGE=KZ
 NODE=M026W;LINKAGE=NN
 NODE=M026W;LINKAGE=L

$\eta_c(1S)$ DECAY MODES

NODE=M026215;NODE=M026

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Decays involving hadronic resonances		
$\Gamma_1 \quad \eta'(958) \pi \pi$	(2.0 ± 0.4) %	S=1.4
$\Gamma_2 \quad \eta'(958) K \bar{K}$	(1.73 ± 0.35) %	
$\Gamma_3 \quad \eta'(958) \eta \eta$	(3.4 ± 0.6) × 10 ⁻³	
$\Gamma_4 \quad \rho \rho$	(1.8 ± 0.4) %	
$\Gamma_5 \quad K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(1.8 ± 0.5) %	
$\Gamma_6 \quad K^*(892) \bar{K}^*(892)$	(7.0 ± 1.2) × 10 ⁻³	
$\Gamma_7 \quad K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.4 ± 0.6) %	
$\Gamma_8 \quad \phi K^+ K^-$	(3.3 $^{+1.2}_{-1.1}$) × 10 ⁻³	
$\Gamma_9 \quad \phi \phi$	(1.8 ± 0.4) × 10 ⁻³	S=2.3
$\Gamma_{10} \quad \phi 2(\pi^+ \pi^-)$	< 4 × 10 ⁻³	CL=90%
$\Gamma_{11} \quad a_0(980) \pi$	seen	
$\Gamma_{12} \quad a_2(1320) \pi$	seen	
$\Gamma_{13} \quad K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	CL=90%
$\Gamma_{14} \quad f_2(1270) \eta$	seen	
$\Gamma_{15} \quad f_2(1270) \eta'$	seen	
$\Gamma_{16} \quad \omega \omega$	(2.7 ± 0.9) × 10 ⁻³	S=2.1
$\Gamma_{17} \quad \omega \phi$	< 2.5 × 10 ⁻⁴	CL=90%
$\Gamma_{18} \quad f_2(1270) f_2(1270)$	(1.08 ± 0.27) %	
$\Gamma_{19} \quad f_2(1270) f'_2(1525)$	(9.7 ± 3.2) × 10 ⁻³	

NODE=M026;CLUMP=A

DESIG=24

DESIG=85

DESIG=93

DESIG=19

DESIG=26

DESIG=18

DESIG=57

DESIG=28

DESIG=17

DESIG=58

DESIG=21

DESIG=22

DESIG=40

DESIG=23

DESIG=92

DESIG=20

DESIG=47

DESIG=46

DESIG=59

Г ₂₀	$f_0(500)\eta$	seen	DESIG=86
Г ₂₁	$f_0(500)\eta'$	seen	DESIG=87
Г ₂₂	$f_0(980)\eta$	seen	DESIG=70
Г ₂₃	$f_0(980)\eta'$	seen	DESIG=88
Г ₂₄	$f_0(1500)\eta$	seen	DESIG=71
Г ₂₅	$f_0(1710)\eta'$	seen	DESIG=90
Г ₂₆	$f_0(2100)\eta'$	seen	DESIG=91
Г ₂₇	$f_0(2200)\eta$	seen	DESIG=72
Г ₂₈	$a_0(1320)\pi$	seen	DESIG=74
Г ₂₉	$a_0(1450)\pi$	seen	DESIG=75
Г ₃₀	$a_2(1700)\pi$	seen	DESIG=94
Г ₃₁	$a_0(1710)\pi$	seen	DESIG=97
Г ₃₂	$a_0(1950)\pi$	seen	DESIG=79
Г ₃₃	$K_0^*(1430)\bar{K} + \text{c.c.}$	seen	DESIG=76
Г ₃₄	$K_2^*(1430)\bar{K} + \text{c.c.}$	seen	DESIG=77
Г ₃₅	$K_0^*(1950)\bar{K} + \text{c.c.}$	seen	DESIG=78
Г ₃₆	$K_0^*(2600)\bar{K} + \text{c.c.}$	seen	DESIG=95

Decays into stable hadrons

Г ₃₇	$K\bar{K}\pi$	(7.1 ± 0.4) %	S=1.1	NODE=M026;CLUMP=B DESIG=14
Г ₃₈	$K\bar{K}\eta$	(1.32±0.15) %		DESIG=25
Г ₃₉	$\eta\pi^+\pi^-$	(1.6 ± 0.4) %		DESIG=16
Г ₄₀	$\eta 2(\pi^+\pi^-)$	(4.3 ± 1.3) %		DESIG=61
Г ₄₁	$K^+K^-\pi^+\pi^-$	(8.3 ± 1.8) × 10 ⁻³	S=1.9	DESIG=15
Г ₄₂	$K^+K^-\pi^+\pi^-\pi^0$	(3.4 ± 0.6) %		DESIG=60
Г ₄₃	$K^0K^-\pi^+\pi^-\pi^+ + \text{c.c.}$	(5.4 ± 1.5) %		DESIG=62
Г ₄₄	$K^+K^-2(\pi^+\pi^-)$	(8.4 ± 2.4) × 10 ⁻³		DESIG=55
Г ₄₅	$2(K^+K^-)$	(1.4 ± 0.4) × 10 ⁻³	S=1.4	DESIG=27
Г ₄₆	$\pi^+\pi^-\pi^0$	< 4 × 10 ⁻⁴	CL=90%	DESIG=81
Г ₄₇	$\pi^+\pi^-\pi^0\pi^0$	(4.6 ± 1.0) %		DESIG=63
Г ₄₈	$2(\pi^+\pi^-)$	(9.6 ± 1.5) × 10 ⁻³	S=1.4	DESIG=11
Г ₄₉	$2(\pi^+\pi^-\pi^0)$	(15.9 ± 2.0) %		DESIG=64
Г ₅₀	$3(\pi^+\pi^-)$	(1.89±0.34) %		DESIG=56
Г ₅₁	$p\bar{p}$	(1.33±0.11) × 10 ⁻³	S=1.1	DESIG=12
Г ₅₂	$p\bar{p}\pi^0$	(3.4 ± 1.3) × 10 ⁻³		DESIG=65
Г ₅₃	$p\bar{p}\pi^+\pi^-$	(3.7 ± 0.5) × 10 ⁻³		DESIG=13
Г ₅₄	$\Lambda\bar{\Lambda}$	(1.10±0.28) × 10 ⁻³	S=1.5	DESIG=45
Г ₅₅	$K^+\bar{p}\Lambda + \text{c.c.}$	(2.5 ± 0.4) × 10 ⁻³		DESIG=82
Г ₅₆	$\bar{\Lambda}(1520)\Lambda + \text{c.c.}$	(3.0 ± 1.3) × 10 ⁻³		DESIG=83
Г ₅₇	$\Sigma^+\bar{\Sigma}^-$	(2.6 ± 0.5) × 10 ⁻³		DESIG=66
Г ₅₈	$\Xi^-\bar{\Xi}^+$	(1.07±0.24) × 10 ⁻³		DESIG=67

Radiative decays

Г ₅₉	$\gamma\gamma$	(1.66±0.13) × 10 ⁻⁴	S=1.2	NODE=M026;CLUMP=C DESIG=31

**Charge conjugation (C), Parity (P),
Lepton Family number (LF) violating modes**

Г ₆₀	$\pi^+\pi^-$	$P, CP < 1.3$	× 10 ⁻⁴	CL=90%	DESIG=51
Г ₆₁	$\pi^0\pi^0$	$P, CP < 4$	× 10 ⁻⁵	CL=90%	DESIG=52
Г ₆₂	K^+K^-	$P, CP < 7$	× 10 ⁻⁴	CL=90%	DESIG=53
Г ₆₃	$K_S^0K_S^0$	$P, CP < 4$	× 10 ⁻⁴	CL=90%	DESIG=54

- ¹ Assuming there is no interference with the non-resonant background.
² Calculated by us using $\Gamma(\eta_c \rightarrow K\bar{K}\pi) \times \Gamma(\eta_c \rightarrow \gamma\gamma) / \Gamma = 0.44 \pm 0.05$ keV from PDG 06 and $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.
³ Systematic errors not evaluated.
⁴ Normalized to $B(\eta_c \rightarrow \rho\bar{\rho}) = (1.3 \pm 0.4) \times 10^{-3}$.
⁵ Normalized to $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$.
⁶ Average of $K_S^0 K^\pm \pi^\mp$, $\pi^+ \pi^- K^+ K^-$, and $2(K^+ K^-)$ decay modes.
⁷ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
⁸ Superseded by ASNER 04.
⁹ Normalized to the sum of 9 branching ratios.
¹⁰ Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow \phi\phi)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
¹¹ Superseded by ACCIARRI 99T.
¹² Normalized to the sum of $B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp)$, $B(\eta_c \rightarrow 2K^+ 2K^-)$, $B(\eta_c \rightarrow K^+ K^- \pi^+ \pi^-)$, and $B(\eta_c \rightarrow 2\pi^+ 2\pi^-)$.
¹³ Re-evaluated by AIHARA 88D.

NODE=M026W1;LINKAGE=ZH
 NODE=M026W1;LINKAGE=AU

NODE=M026W1;LINKAGE=NS
 NODE=M026W1;LINKAGE=N3
 NODE=M026W1;LINKAGE=N2
 NODE=M026W;LINKAGE=FF
 NODE=M026W1;LINKAGE=N6

NODE=M026W1;LINKAGE=NN
 NODE=M026W1;LINKAGE=N1
 NODE=M026W1;LINKAGE=N5

NODE=M026W1;LINKAGE=WD
 NODE=M026W1;LINKAGE=N4

NODE=M026W1;LINKAGE=A

$\eta_c(1S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

$\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{59} / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
102 ± 18 OUR FIT	Error includes scale factor of 1.5.	[101 ± 12 eV OUR 2023 FIT]		
98.1 ± 3.9 ± 11.7	2673	XU	18	BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$75.8^{+6.3}_{-6.2} \pm 8.4$	486	¹ ZHANG	12A	BELL $e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
¹ Superseded by XU 18.				

NODE=M026220

NODE=M026G10
 NODE=M026G10
 NEW

NODE=M026G10;LINKAGE=A

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_4 \Gamma_{59} / \Gamma$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<39	90	< 1556	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G09
 NODE=M026G09

$\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_6 \Gamma_{59} / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
35 ± 6 OUR FIT				
[34 ± 6 eV OUR 2023 FIT]				
32.4 ± 4.2 ± 5.8	882 ± 115	UEHARA	08	BELL $\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G08
 NODE=M026G08
 NEW

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_{59} / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
9.2 ± 2.2 OUR FIT	Error includes scale factor of 2.7.	[8.5 ± 0.9 eV OUR 2023 FIT]		
7.75 ± 0.66 ± 0.62	386 ± 31	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
6.8 ± 1.2 ± 1.3	132 ± 23	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$
¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.				

NODE=M026G07
 NODE=M026G07
 NEW

NODE=M026G07;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{16} \Gamma_{59} / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
13 ± 5 OUR FIT	Error includes scale factor of 2.2.	[11.0 ± 2.5 eV OUR 2023 FIT]		
8.67 ± 2.86 ± 0.96	85 ± 29	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^- \pi^0)$
¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.				

NODE=M026G03
 NODE=M026G03
 NEW

NODE=M026G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{17} \Gamma_{59} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.49	90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.				

NODE=M026G04
 NODE=M026G04

NODE=M026G04;LINKAGE=LI

$\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{18} \Gamma_{59} / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
55 ± 14 OUR FIT				
[52 ± 13 eV OUR 2023 FIT]				
69 ± 17 ± 12	3182 ± 766	UEHARA	08	BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G19
 NODE=M026G19
 NEW

$$\Gamma(f_2(1270)f'_2(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49±9±13	1128±206	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

NODE=M026G20
NODE=M026G20

$$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{37}\Gamma_{59}/\Gamma$$

VALUE (keV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
0.360±0.022 OUR FIT	Error includes scale factor of 1.5.	[0.378±0.021 keV OUR 2023 FIT]		

NODE=M026G14
NODE=M026G14

NEW

0.396±0.016 OUR AVERAGE

[0.407±0.027 keV OUR 2023 AVERAGE Scale factor = 1.2]

NEW

0.386±0.008±0.021	12k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
0.374±0.009±0.031	14k	¹ LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
0.407±0.022±0.028		^{2,3} ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta'_C \rightarrow K_S^0 K^\pm \pi^\mp$
0.60 ±0.12 ±0.09	41	^{3,4} ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
1.47 ±0.87 ±0.27		³ SHIRAI	98 AMY	$\gamma\gamma \rightarrow \eta_C \rightarrow K^\pm K_S^0 \pi^\mp$
0.84 ±0.21		³ ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^\pm K_S^0 \pi^\mp$
0.60 ^{+0.23} _{-0.20}		³ CHEN	90B CLEO	$\gamma\gamma \rightarrow \eta_C K^\pm K_S^0 \pi^\mp$
1.06 ±0.41 ±0.27	11	³ BRAUNSCH...	89 TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$
1.5 ^{+0.60} _{-0.45} ±0.3	7	³ BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.418±0.044±0.022		^{3,5} BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_C \rightarrow K^\pm K_S^0 \pi^\mp$
<0.63	95	³ BEHREND	89 CELL	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
<4.4	95	ALTHOFF	85B TASS	$\gamma\gamma \rightarrow K\bar{K}\pi$

¹ From the corrected and unfolded mass spectrum.

² Calculated by us from the value reported in ASNER 04 that assumes $B(\eta_C \rightarrow K\bar{K}\pi) = 5.5 \pm 1.7\%$

³ We have multiplied $K^\pm K_S^0 \pi^\mp$ measurement by 3 to obtain $K\bar{K}\pi$.

⁴ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_C \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

⁵ Superseded by ASNER 04.

NODE=M026G14;LINKAGE=LE
NODE=M026G14;LINKAGE=AA

NODE=M026G14;LINKAGE=C
NODE=M026G;LINKAGE=BB

NODE=M026G14;LINKAGE=NN

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
42 ± 9 OUR FIT	Error includes scale factor of 2.1.	[35 ± 5 eV OUR 2023 FIT]		
27 ± 6 OUR AVERAGE				

NODE=M026G15
NODE=M026G15

NEW

25.7± 3.2± 4.9	2019±248	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
280 ±100 ±60	42	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$
170 ± 80 ±20	13.9 ± 6.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow \pi^+\pi^-K^+K^-$

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_C \rightarrow \pi^+\pi^-K^+K^-) = (2.0 \pm 0.7)\%$.

NODE=M026G;LINKAGE=CC

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_{59}/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.190±0.006±0.028	11k	DEL-AMO-SA...11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M026G02
NODE=M026G02

$$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.2± 2.1 OUR FIT	Error includes scale factor of 1.5.	[7.4 ± 1.5 eV OUR 2023 FIT]		
5.8± 1.9 OUR AVERAGE				

NODE=M026G27
NODE=M026G27

NEW

5.6± 1.1± 1.6	216 ± 42	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(K^+K^-)$
350 ±90 ±60	46	¹ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow 2(K^+K^-)$
231 ±90 ±23	9.1 ± 3.3	² ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(K^+K^-)$

¹ Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_C \rightarrow 2(K^+K^-)) = (2.1 \pm 1.2)\%$.

NODE=M026G;LINKAGE=DD

² Includes all topological modes except $\eta_C \rightarrow \phi\phi$.

NODE=M026G;LINKAGE=EE

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{48}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
48 ± 7 OUR FIT	Error includes scale factor of 1.5. [47 ± 5 eV OUR 2023 FIT]			
42 ± 6 OUR AVERAGE				
40.7 ± 3.7 ± 5.3	5381 ± 492	UEHARA	08 BELL	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$
180 ± 70 ± 20	21.4 ± 8.6	ALBRECHT	94H ARG	$\gamma\gamma \rightarrow 2(\pi^+\pi^-)$

NODE=M026G11
 NODE=M026G11
 NEW

$$\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_{59}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.7 ± 0.6 OUR FIT	Error includes scale factor of 1.1. [7.3 ± 0.7 eV OUR 2023 FIT]			
6.2 $\frac{+1.1}{-1.0}$ OUR AVERAGE	Error includes scale factor of 1.1. [7.2 ± 1.7 eV OUR 2023 AVERAGE]			

NODE=M026G01
 NODE=M026G01
 NEW
 NEW

7.20 ± 1.53 $\frac{+0.67}{-0.75}$	157 ± 33	¹ KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$
4.6 $\frac{+1.3}{-1.1}$ ± 0.4	190	AMBROGIANI	03 E835	$\bar{p}p \rightarrow \gamma\gamma$
8.1 $\frac{+2.9}{-2.0}$		ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$

¹ Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

NODE=M026G01;LINKAGE=GG

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

$$\Gamma(\eta'(958)K\bar{K})/\Gamma(\eta'(958)\pi\pi) \quad \Gamma_2/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.859 ± 0.052 ± 0.043	¹ LEES	21A BABR	$\gamma\gamma \rightarrow \eta' K^+ K^-, \eta' \pi^+ \pi^-$

NODE=M026R55
 NODE=M026R55

¹ Based on Dalitz-plot analysis of the $\eta_c \rightarrow \eta' K^+ K^-, \eta' \pi^+ \pi^-$ final states where the fit fractions and relative phases are determined for numerous two-body intermediate states.

NODE=M026R55;LINKAGE=A

$$\Gamma(\eta'(958)\eta\eta)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT
3.4 ± 0.5 ± 0.3	¹ ABLIKIM	21C BES3	$J/\psi(1S) \rightarrow \gamma\eta\eta\eta'$

NODE=M026R63
 NODE=M026R63

¹ ABLIKIM 21C reports $[\Gamma(\eta_c(1S) \rightarrow \eta'(958)\eta\eta)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (4.86 \pm 0.62 \pm 0.45) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R63;LINKAGE=A

$$\Gamma(\rho\rho)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10 ⁻²)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1.1 ± 0.5 ± 0.1	72	¹ ABLIKIM	05L BES2	J/ψ → π ⁺ π ⁻ π ⁺ π ⁻ γ	OCCUR=2
2.3 ± 0.5 ± 0.2	113	^{2,3} BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^0\rho^0$	
2.1 ± 1.0 ± 0.2	32	^{4,5} BISELLO	91 DM2	$J/\psi \rightarrow \gamma\rho^+\rho^-$	
<14	90	⁶ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$	

NODE=M026R9
 NODE=M026R9

¹ ABLIKIM 05L reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.6 \pm 0.6 \pm 0.4) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R9;LINKAGE=F

² BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.30 \pm 0.30 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R9;LINKAGE=A

³ The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

NODE=M026R9;LINKAGE=B

⁴ BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (3.0 \pm 1.3 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R9;LINKAGE=C

⁵ The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

NODE=M026R9;LINKAGE=D

⁶ Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R9;LINKAGE=G

$\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.8 \pm 0.4 \pm 0.2$	63	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (2.6 \pm 0.6) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R16
NODE=M026R16

NODE=M026R16;LINKAGE=A

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$135 \pm 57 \pm 13$	45	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow K^{*0} \bar{K}^{*0} \pi^+ \pi^- \gamma$

¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.91 \pm 0.64 \pm 0.48) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R25
NODE=M026R25

NODE=M026R25;LINKAGE=AB

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.9^{+0.9}_{-0.8} \pm 1.1$	$14.1^{+4.4}_{-3.7}$	¹ HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R21
NODE=M026R21

NODE=M026R;LINKAGE=BB

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<40	90	¹ ABLIKIM	06A BES2	$J/\psi \rightarrow \phi 2(\pi^+ \pi^-) \gamma$

¹ ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow \phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] < 0.603 \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R26
NODE=M026R26

NODE=M026R26;LINKAGE=AB

 $\Gamma(a_0(980) \pi)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

seen		AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$

seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.02	90	^{1,2} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

² We are assuming $B(a_0(980) \rightarrow \eta \pi) > 0.5$.

NODE=M026R11
NODE=M026R11

NODE=M026R11;LINKAGE=E
NODE=M026R11;LINKAGE=F

 $\Gamma(a_2(1320) \pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

seen	[<0.02 (CL = 90%) OUR 2022 BEST LIMIT]			

seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.02	90	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R12
NODE=M026R12

NODE=M026R12;LINKAGE=E

 $\Gamma(K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.0128	90	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

<0.0132	90	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R17
NODE=M026R17

OCCUR=2

NODE=M026R17;LINKAGE=E

$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta$

NODE=M026R13
 NODE=M026R13

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.011 90 ¹ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R13;LINKAGE=E

 $\Gamma(f_2(1270)\eta')/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta'$; $K^+K^-\eta'$

NODE=M026R60
 NODE=M026R60

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5×10^{-4}	90	¹ ABLIKIM	17P BES3	$J/\psi \rightarrow \pi^+\pi^-\pi^0 K^+K^-\gamma$
<17 $\times 10^{-4}$	90	² ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+\pi^-\pi^0 K^+K^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Using $B(J/\psi \rightarrow \gamma \eta_c) = 0.017 \pm 0.004$.

² The quoted branching ratio uses $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R22
 NODE=M026R22

NODE=M026R22;LINKAGE=A
 NODE=M026R22;LINKAGE=E

 $\Gamma(f_0(500)\eta)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta$

NODE=M026R57
 NODE=M026R57

 $\Gamma(f_0(500)\eta')/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c(1S) \rightarrow \pi^+\pi^-\eta'$

NODE=M026R58
 NODE=M026R58

 $\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta$

NODE=M026R41
 NODE=M026R41

 $\Gamma(f_0(980)\eta')/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta'$, $K^+K^-\eta'$

NODE=M026R56
 NODE=M026R56

 $\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta$

NODE=M026R42
 NODE=M026R42

 $\Gamma(f_0(1710)\eta')/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta'$

NODE=M026R59
 NODE=M026R59

 $\Gamma(f_0(2100)\eta')/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+\pi^-\eta$

NODE=M026R61
 NODE=M026R61

 $\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\eta$

NODE=M026R43
 NODE=M026R43

 $\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+K^-\pi^0$

NODE=M026R45
 NODE=M026R45

$\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

 Γ_{29}/Γ NODE=M026R46
NODE=M026R46 $\Gamma(a_2(1700)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

 Γ_{30}/Γ NODE=M026P10
NODE=M026P10 $\Gamma(a_0(1710)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow \pi^+ \pi^- \eta'$

 Γ_{31}/Γ NODE=M026P13
NODE=M026P13 $\Gamma(a_0(1950)\pi)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		LEES	21A BABR	Dalitz anal. of $\eta_c(1S) \rightarrow \pi^+ \pi^- \eta'$
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$

 Γ_{32}/Γ NODE=M026R00
NODE=M026R00¹ From a model-independant partial wave analysis.

NODE=M026R00;LINKAGE=A

 $\Gamma(K_0^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta/\pi^0$

 Γ_{33}/Γ NODE=M026R47
NODE=M026R47¹ From a model-independant partial wave analysis.

NODE=M026R47;LINKAGE=A

 $\Gamma(K_2^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen	LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta'$
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

 Γ_{34}/Γ NODE=M026R48
NODE=M026R48 $\Gamma(K_0^*(1950)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
seen		LEES	21A BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta'$
seen	12k	¹ LEES	16A BABR	$\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K \bar{K} \pi$
seen		LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta/\pi^0$

 Γ_{35}/Γ NODE=M026R49
NODE=M026R49¹ From a Dalitz plot analysis using an isobar model.

NODE=M026R49;LINKAGE=A

 $\Gamma(K_0^*(2600)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

 Γ_{36}/Γ NODE=M026P11
NODE=M026P11 $\Gamma(K \bar{K} \pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{37}/Γ NODE=M026R4
NODE=M026R4**7.1±0.4 OUR FIT** Error includes scale factor of 1.1. $[(7.0 \pm 0.4) \times 10^{-2} \text{ OUR 2023 FIT}]$

NEW

7.4±0.6 OUR AVERAGE $[(6.7 \pm 0.5) \times 10^{-2} \text{ OUR 2023 AVERAGE Scale factor} = 1.1]$

NEW

6.9±0.7±0.6 146 ¹ ABLIKIM 19AP BES3 $h_c \rightarrow \gamma \eta_c$ 7.8±0.6±0.6 267 ² ABLIKIM 19AP BES3 $h_c \rightarrow \gamma \eta_c$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.1±1.2±0.6 55 ^{3,4} ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$ 7.6±1.3±0.8 107 ^{5,6} ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$

OCCUR=2

8.5±1.8 ⁷ AUBERT 06E BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$ 4.7±1.2±0.5 0.6k ^{8,9} BAI 04 BES $J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$ 6.2±1.7±0.6 33 ^{10,11} BISELLO 91 DM2 $J/\psi \rightarrow \gamma K^+ K^- \pi^0$

$\Gamma(\phi K^+ K^-)/\Gamma(K \bar{K} \pi)$ $\Gamma_{8/\Gamma_{37}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
$0.052^{+0.016}_{-0.014} \pm 0.014$	7	¹ HUANG	03	BELL $B^\pm \rightarrow K^\pm \phi \phi$

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12^{+0.10}_{-0.12}) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K \bar{K} \pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R02
NODE=M026R02

NODE=M026R02;LINKAGE=BB

 $\Gamma(K \bar{K} \eta)/\Gamma_{\text{total}}$ $\Gamma_{38/\Gamma}$

VALUE (units 10^{-2})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.9 \pm 0.5 \pm 0.1$	7	^{1,2} ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$
< 3.1	90	³ BALTRUSAIT..86	MRK3		$J/\psi \rightarrow \eta_c \gamma$

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K \bar{K} \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R15
NODE=M026R15

OCCUR=2

NODE=M026R15;LINKAGE=AK

NODE=M026R15;LINKAGE=AM

NODE=M026R15;LINKAGE=E

 $\Gamma(K \bar{K} \eta)/\Gamma(K \bar{K} \pi)$ $\Gamma_{38/\Gamma_{37}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.186 ± 0.018 OUR FIT

[0.187 ± 0.018 OUR 2023 FIT]

0.190 ± 0.008 ± 0.017	5.4k	¹ LEES	14E	BABR $\gamma \gamma \rightarrow K^+ K^- \eta/\pi^0$

¹ LEES 14E reports $B(\eta_c(1S) \rightarrow K^+ K^- \eta)/B(\eta_c(1S) \rightarrow K^+ K^- \pi^0) = 0.571 \pm 0.025 \pm 0.051$, which we divide by 3 to account for isospin symmetry. It uses both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

NODE=M026R40
NODE=M026R40
NEW

NODE=M026R40;LINKAGE=LE

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ $\Gamma_{39/\Gamma}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

1.6 ± 0.4 OUR AVERAGE [(1.7 ± 0.5) × 10⁻² OUR 2023 AVERAGE]

1.6 ± 0.4 ± 0.2	33	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.4 ± 2.0	75	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
3.7 ± 1.3 ± 2.0	18	² PARTRIDGE	80B	CBAL $J/\psi \rightarrow \eta \pi^+ \pi^- \gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$. Where relevant, the error in this branching ratio is treated as a common systematic in computing averages.

NODE=M026R6
NODE=M026R6

NEW

NODE=M026R6;LINKAGE=AB

NODE=M026R6;LINKAGE=E

 $\Gamma(\eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ $\Gamma_{40/\Gamma}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

4.3 ± 1.3 OUR AVERAGE [(4.6 ± 1.4) × 10⁻² OUR 2023 AVERAGE]

4.3 ± 1.2 ± 0.4	39	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+ \pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R05
NODE=M026R05

NEW

NODE=M026R05;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$ $\Gamma_{42/\Gamma_{37}}$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

4.77 ± 0.017 ± 0.070	11k	¹ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026R01
NODE=M026R01

NODE=M026R01;LINKAGE=DE

$\Gamma(K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{43}/Γ VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT**5.4±1.5 OUR AVERAGE** [(5.7 ± 1.6) × 10⁻² OUR 2023 AVERAGE]**5.4±1.4±0.5** 43 1,2 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$ ¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^- \pi^- 2\pi^+)$ = (12.01 ± 2.22 ± 2.04) × 10⁻⁶ which we multiply by 2 to take c.c. into account.² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.NODE=M026R06
NODE=M026R06

NEW

NODE=M026R06;LINKAGE=AA

NODE=M026R06;LINKAGE=AB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{44}/Γ VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT**8.4±2.4 OUR AVERAGE**[(7.6 ± 2.4) × 10⁻³ OUR 2023 AVERAGE]8 ±4 ±1 10 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$ 8.6±2.8±0.8 100 ² ABLIKIM 06A BES2 $J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$ ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.21 \pm 0.32 \pm 0.24) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R23
NODE=M026R23

NEW

NODE=M026R23;LINKAGE=AL

NODE=M026R23;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

<4 × 10⁻⁴ (CL = 90%) [$<5 \times 10^{-4}$ (CL = 90%) OUR 2023 BEST LIMIT]**<4 × 10⁻⁴** 90 ¹ ABLIKIM 17AJ BES3 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$ ¹ ABLIKIM 17AJ reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \eta_c(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 3.6 \times 10^{-3}$.NODE=M026R51
NODE=M026R51

NODE=M026R51;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT**4.6±1.0 OUR AVERAGE** [(4.8 ± 1.1) × 10⁻² OUR 2023 AVERAGE]**4.6±0.9±0.5** 118 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \pi^+ \pi^- 2\pi^0$ ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.NODE=M026R07
NODE=M026R07

NEW

NODE=M026R07;LINKAGE=AB

 $\Gamma(2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}}$ Γ_{49}/Γ VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT**15.9±2.0 OUR AVERAGE**[(16.2 ± 2.1) × 10⁻² OUR 2023 AVERAGE]15.3±1.8±1.8 333 ABLIKIM 19AP BES3 $h_c \rightarrow \gamma \eta_c$ 16.8±2.8±1.7 175 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+ \pi^- \pi^0)$ ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.NODE=M026R08
NODE=M026R08

NEW

NODE=M026R08;LINKAGE=AB

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{50}/Γ VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT**18.9±3.4 OUR AVERAGE**[(18 ± 4) × 10⁻³ OUR 2023 AVERAGE]20 ±5 ±2 51 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 3(\pi^+ \pi^-)$ 18 ±4 ±2 479 ² ABLIKIM 06A BES2 $J/\psi \rightarrow 3(\pi^+ \pi^-) \gamma$ NODE=M026R24
NODE=M026R24

NEW

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.
- ² ABLIKIM 06A reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (2.59 \pm 0.32 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R24;LINKAGE=AL

NODE=M026R24;LINKAGE=AB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

13.3± 1.1 OUR FIT Error includes scale factor of 1.1. $[(13.5 \pm 1.3) \times 10^{-4}$ OUR 2023 FIT]

NODE=M026R2
NODE=M026R2

NEW

12.0± 3.0 OUR AVERAGE $[(11.5 \pm 1.9) \times 10^{-4}$ OUR 2023 AVERAGE]

NEW

12.0± 2.6±1.5 34 ABLIKIM 19AP BES3 $h_c \rightarrow \gamma\eta_c$

• • • We do not use the following data for averages, fits, limits, etc. • • •

15 ± 5 ± 1 15 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}$

12.9⁺₋ 1.8_{2.1} ± 0.8 195 ² WU 06 BELL $B^+ \rightarrow p\bar{p}K^+$

13.5 ± 3.0 ± 1.3 213 ³ BAI 04 BES $J/\psi \rightarrow \gamma p\bar{p}$

9.2 ± 3.5 ± 0.9 18 ⁴ BISELLO 91 DM2 $J/\psi \rightarrow \gamma p\bar{p}$

10 ± 5 ± 1 23 ⁵ BALTRUSAITIS 86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

22 ⁺₋ 22₁₁ ± 3 ⁶ HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R2;LINKAGE=AB

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

- ² WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (1.42 \pm 0.11^{+0.16}_{-0.20}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=WU

- ³ BAI 04 reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.9 \pm 0.3 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=C

- ⁴ BISELLO 91 reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (0.13 \pm 0.04 \pm 0.03) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=D

- ⁵ BALTRUSAITIS 86 reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.4 \pm 0.7) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=F

- ⁶ HIMEL 80B reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\eta_c(1S))] = (8^{+8}_{-4}) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = (3.6 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=G

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$ $\Gamma_{51}/\Gamma \times \Gamma_9/\Gamma$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

0.24±0.07 OUR FIT Error includes scale factor of 1.9. $[(0.214 \pm 0.035) \times 10^{-5}$ OUR 2023 FIT]

NODE=M026R33
NODE=M026R33

NEW

4.0 ⁺₋ 3.5_{3.2} BAGLIN 89 SPEC $\bar{p}p \rightarrow K^+ K^- K^+ K^-$

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.34 ± 0.12 ± 0.03 14 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^0$

NODE=M026R09
NODE=M026R09

- ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] \times [B(h_c(1P) \rightarrow \gamma\eta_c(1S))] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma\eta_c(1S)) = (60 \pm 4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M026R09;LINKAGE=AB

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.46^{+0.33}_{-0.32} \pm 0.16$	157	¹ LU	19 BELL	$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M026R53
NODE=M026R53

¹ LU 19 reports $(2.83^{+0.36}_{-0.34} \pm 0.35) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$ assuming $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R53;LINKAGE=A

 $\Gamma(\bar{\Lambda}(1520) \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0$\pm$1.3 OUR AVERAGE		[(3.1 $\pm$ 1.3) $\times 10^{-3}$ OUR 2023 AVERAGE]		
3.0$\pm$1.3$\pm$0.2	43	¹ LU	19 BELL	$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M026R54
NODE=M026R54

NEW

¹ LU 19 reports $(3.48 \pm 1.48 \pm 0.46) \times 10^{-3}$ from a measurement of $[\Gamma(\eta_c(1S) \rightarrow \bar{\Lambda}(1520) \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)]$ assuming $B(B^+ \rightarrow \eta_c K^+) = (9.6 \pm 1.1) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R54;LINKAGE=A

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.6 \pm 0.4 \pm 0.2$	112	¹ ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma p \bar{p} \pi^0 \pi^0$

NODE=M026R28
NODE=M026R28

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (3.60 \pm 0.48 \pm 0.31) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R28;LINKAGE=AB

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.07 \pm 0.22 \pm 0.10$	78	¹ ABLIKIM	13C BES3	$J/\psi \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M026R29
NODE=M026R29

¹ ABLIKIM 13C reports $[\Gamma(\eta_c(1S) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.51 \pm 0.27 \pm 0.14) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R29;LINKAGE=AB

————— RADIATIVE DECAYS —————

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.66$\pm$0.13 OUR FIT		Error includes scale factor of 1.2. [(1.68 $\pm$ 0.12) $\times 10^{-4}$ OUR 2023 FIT]			

NODE=M026310

NODE=M026R31
NODE=M026R31

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.2 \pm 1.0 \pm 0.3$		¹ ABLIKIM	13i	BES3	
$0.9^{+1.9}_{-0.8} \pm 0.1$	$1.2^{+2.8}_{-1.1}$	² ADAMS	08	CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$2.0^{+0.9}_{-0.7} \pm 0.1$	13	³ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
$2.80^{+0.67}_{-0.58} \pm 1.0$		⁴ ARMSTRONG	95F	E760	$\bar{p} p \rightarrow \gamma \gamma$
< 9	90	⁵ BISELLO	91	DM2	$J/\psi \rightarrow \gamma \gamma \gamma$
$6^{+4}_{-3} \pm 4$		⁴ BAGLIN	87B	SPEC	$\bar{p} p \rightarrow \gamma \gamma$
< 18	90	⁶ BLOOM	83	CBAL	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R31;LINKAGE=AL

¹ ABLIKIM 13i reports $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (4.5 \pm 1.2 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ADAMS 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (1.2^{+2.7}_{-1.1} \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.41 \pm 0.14) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R31;LINKAGE=AD

³WICHT 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (2.2^{+0.9+0.4}_{-0.7-0.2}) \times 10^{-7}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (1.10 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴Not independent from the values of the total and two-photon width quoted by the same experiment.

⁵The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

⁶Using $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=W1

NODE=M026R31;LINKAGE=AB

NODE=M026R31;LINKAGE=E

NODE=M026R31;LINKAGE=C

$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{59}/\Gamma$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
0.221 ± 0.019 OUR FIT Error includes scale factor of 1.2. $[(0.228 \pm 0.022) \times 10^{-6} \text{ OUR 2023 FIT}]$

NODE=M026R32

NODE=M026R32

NEW

0.26 ± 0.05 OUR AVERAGE Error includes scale factor of 1.4.

0.224^{+0.038}_{-0.037} ± 0.020 190 AMBROGIANI 03 E835 $\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$

0.336^{+0.080}_{-0.070} ARMSTRONG 95F E760 $\bar{p}p \rightarrow \gamma\gamma$

0.68^{+0.42}_{-0.31} 12 BAGLIN 87B SPEC $\bar{p}p \rightarrow \gamma\gamma$

———— Charge conjugation (C), Parity (P), ————
 ———— Lepton family number (LF) violating modes ————

NODE=M026320

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{60}/\Gamma$

VALUE (units 10^{-5}) CL% DOCUMENT ID TECN COMMENT
<13 (CL = 90%) [$<11 \times 10^{-5}$ (CL = 90%) OUR 2023 BEST LIMIT]

NODE=M026R34

NODE=M026R34

<13 90 ¹ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<80 90 ²ABLIKIM 06B BES2 $J/\psi \rightarrow \pi^+\pi^-\gamma$

¹ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.82 \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R34;LINKAGE=AL

²ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 1.1 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R34;LINKAGE=AB

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{61}/\Gamma$

VALUE (units 10^{-5}) CL% DOCUMENT ID TECN COMMENT
< 4 90 ¹ABLIKIM 11G BES3 $J/\psi \rightarrow \gamma\pi^0\pi^0$

NODE=M026R35

NODE=M026R35

• • • We do not use the following data for averages, fits, limits, etc. • • •

<50 90 ²ABLIKIM 06B BES2 $J/\psi \rightarrow \pi^0\pi^0\gamma$

¹ABLIKIM 11G reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R35;LINKAGE=AL

²ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow \pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.71 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R35;LINKAGE=AB

$\Gamma(K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{62}/\Gamma$

VALUE (units 10^{-5}) CL% DOCUMENT ID TECN COMMENT
<70 (CL = 90%) [$<60 \times 10^{-5}$ (CL = 90%) OUR 2023 BEST LIMIT]

NODE=M026R36

NODE=M026R36

<70 90 ¹ABLIKIM 06B BES2 $J/\psi \rightarrow K^+K^-\gamma$

¹ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.96 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R36;LINKAGE=AB

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}} \quad \Gamma_{63}/\Gamma$

VALUE (units 10^{-5}) CL% DOCUMENT ID TECN COMMENT
<40 (CL = 90%) [$<31 \times 10^{-5}$ (CL = 90%) OUR 2023 BEST LIMIT]

NODE=M026R37

NODE=M026R37

<40 90 ¹ABLIKIM 06B BES2 $J/\psi \rightarrow K_S^0 K_S^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<32 90 ^{2,3}UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

< 5.6 90 ^{4,5}UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

OCCUR=2

¹ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] < 0.53 \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.41 \times 10^{-2}$.

NODE=M026R37;LINKAGE=AB

²Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 1.6$ eV.

NODE=M026R37;LINKAGE=A

³Taking into account interference with the non-resonant continuum.

NODE=M026R37;LINKAGE=U1

⁴Using $\Gamma(\gamma\gamma)(\eta_c) = 5.3 \pm 0.5$ keV. UEHARA 13 reports $\Gamma(\gamma\gamma) \times B(K_S^0 K_S^0) < 0.29$ eV.

NODE=M026R37;LINKAGE=B

⁵Neglecting interference with the non-resonant continuum.

NODE=M026R37;LINKAGE=U2

$\eta_c(1S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M026230

$$\Gamma(\eta_c(1S) \rightarrow \eta'(958)\pi\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R64
NODE=M026R64

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.8 ± 0.5 OUR FIT		Error includes scale factor of 1.4.		
5.25± 1.65	14	¹ BALTRUSAITIS 86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The value reported by BALTRUSAITIS 86 has been multiplied by 3/2 to account for isospin symmetry.

NODE=M026R64;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \rho\rho)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_4/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R65
NODE=M026R65

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.2.		
1.6 $\pm 0.6 \pm 0.4$	72	ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
3.30 $\pm 0.30 \pm 0.60$	113	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
3.0 $\pm 1.3 \pm 0.6$	32	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$

¹ The value reported by BISELLO 91 has been multiplied by 3 to account for isospin symmetry.

OCCUR=2

NODE=M026R65;LINKAGE=A

² The value reported by BISELLO 91 has been multiplied by 3/2 to account for isospin symmetry.

NODE=M026R65;LINKAGE=B

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R66
NODE=M026R66

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6± 0.6	63	BALTRUSAITIS 86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)\bar{K}^*(892))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R67
NODE=M026R67

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.99± 0.17 OUR FIT				
1.17± 0.29 OUR AVERAGE				
1.4 $\pm 0.3 \pm 0.5$	60	ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
1.04 $\pm 0.36 \pm 0.18$	14	¹ BISELLO	91 DM2	$e^+ e^- \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
1.2 ± 0.6	9	¹ BALTRUSAITIS 86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The reported value has been multiplied by 2 to account for isospin symmetry.

NODE=M026R67;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R68
NODE=M026R68

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.91$\pm 0.64 \pm 0.48$	45	ABLIKIM	06A BES2	$J/\psi \rightarrow K^{*0} \bar{K}^{*0} \pi^+ \pi^- \gamma$

$$\Gamma(\eta_c(1S) \rightarrow \phi K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

NODE=M026R69
NODE=M026R69

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.6± 1.1 -0.9 ± 0.8	14.1 ± 4.4 -3.7	HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

NODE=M026R80
NODE=M026R80

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6± 0.6 OUR FIT		Error includes scale factor of 2.2.		
4.1± 0.6 OUR AVERAGE		Error includes scale factor of 1.2.		

4.3 ± 0.5 -1.2	1.2k	ABLIKIM	17P BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.3 $\pm 0.6 \pm 0.6$	72	ABLIKIM	05L BES2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.9 $\pm 0.9 \pm 0.7$	19	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
3.8 ± 2.3 -1.5 ± 0.7	5	BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
9.3 $\pm 2.0 \pm 1.6$	80	BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
8.5 $\pm 2.7 \pm 1.8$		BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

OCCUR=2

OCCUR=3

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.3 $\pm 0.6 \pm 0.6$	357	¹ BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$

¹ Superseded by ABLIKIM 05L.

NODE=M026R80;LINKAGE=E

$$\Gamma(\eta_c(1S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

2.0±0.5 OUR FIT Error includes scale factor of 2.2.

3.3^{+1.2}_{-1.0} OUR AVERAGE Error includes scale factor of 1.5.

4.7±1.2±0.5		AUBERT,B	04B	BABR	$B^\pm \rightarrow K^\pm \eta_c$
2.2 ^{+1.0} _{-0.7} ±0.5	7	HUANG	03	BELL	$B^\pm \rightarrow K^\pm \phi\phi$

NODE=M026R70
NODE=M026R70

$$\Gamma(\eta_c(1S) \rightarrow \omega\omega)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.7 ±1.2 OUR FIT Error includes scale factor of 2.1.

4.90±0.17±0.77 1705 ABLIKIM 19AV BES3 $J/\psi \rightarrow \gamma\omega\omega$

NODE=M026R71
NODE=M026R71

$$\Gamma(\eta_c(1S) \rightarrow f_2(1270) f_2(1270))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

1.5±0.4 OUR FIT

1.3±0.3^{+0.3}_{-0.4} 91.2 ± 19.8 ABLIKIM 04M BES $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M026R72
NODE=M026R72

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

10.1 ±0.9 OUR FIT Error includes scale factor of 1.5.

6.7 ±0.8 OUR AVERAGE

6.6 ±0.9 ±1.5	0.6k	¹ BAI	04	BES	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
8.76±1.80±1.68	33	² BISELLO	91	DM2	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
6.9 ±1.2 ±1.2	68	³ BISELLO	91	DM2	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$
7.8 ±3.0	32	⁴ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$	
5.7 ±1.5	63	⁵ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \gamma K^\pm \pi^\mp K_S^0$	

NODE=M026R73
NODE=M026R73

OCCUR=2

OCCUR=2

¹ BAI 04 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.2 \pm 0.3 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

² BISELLO 91 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.46 \pm 0.30 \pm 0.28) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

³ BISELLO 91 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (2.3 \pm 0.4 \pm 0.4) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

⁴ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (1.3 \pm 0.5) \times 10^{-4}$ which we multiply by 6 to account for isospin symmetry.

⁵ BALTRUSAITIS 86 reports $B(J/\psi \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^\pm K_S^0 \pi^\mp) = (1.9 \pm 0.5) \times 10^{-4}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R73;LINKAGE=A

NODE=M026R73;LINKAGE=B

NODE=M026R73;LINKAGE=C

NODE=M026R73;LINKAGE=D

NODE=M026R73;LINKAGE=E

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

7.9 ±0.5 OUR FIT Error includes scale factor of 1.1.

7.5 ±0.8 OUR AVERAGE

8.01±0.42^{+1.71}_{-1.65} ¹ VINOKUROVA 11 BELL $e^+ e^- \rightarrow \Upsilon(4S)$

7.4 ±0.5 ±0.7 AUBERT,B 04B BABR $B^\pm \rightarrow K^\pm \eta_c$

¹ VINOKUROVA 11 reports $B(B^+ \rightarrow \eta_c K^+, \eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (26.7 \pm 1.4 \pm 2.9 \pm 4.9) \times 10^{-6}$, where the first uncertainty is statistical, the second is due to systematics, and the third comes from interference of $\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp$ with nonresonant $K_S^0 K^\pm \pi^\mp$. We combined both systematic uncertainties to single values. We multiply the reported result by 3 to account for isospin symmetry.

NODE=M026R74
NODE=M026R74

NODE=M026R74;LINKAGE=D

$$\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

2.6±0.4 OUR FIT Error includes scale factor of 1.3.

4.5^{+2.4}_{-1.8} HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R75
NODE=M026R75

$$\frac{\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}}{\Gamma_{37}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}}$$

NODE=M026R76
NODE=M026R76

VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

4.28±0.34 OUR FIT

4.1 ±0.6 OUR AVERAGE

3.7 ±0.7 ±0.3	55	^{1,2} ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^0$
4.6 ±0.8 ±0.3	107	^{3,4} ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\pm$

OCCUR=2

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

NODE=M026R76;LINKAGE=A

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R76;LINKAGE=B

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (11.35 \pm 1.25 \pm 1.50) \times 10^{-6}$ which we multiply by 3 to account for isospin symmetry.

NODE=M026R76;LINKAGE=C

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R76;LINKAGE=D

$$\frac{\Gamma(\eta_c(1S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}}{\Gamma_{38}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}}$$

NODE=M026R77
NODE=M026R77

VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

7.9±1.0 OUR FIT

5.7±2.9±0.4	7	^{1,2} ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+ K^- \eta) = (2.11 \pm 1.01 \pm 0.32) \times 10^{-6}$ which we multiply by 2 to account for isospin symmetry.

NODE=M026R77;LINKAGE=A

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R77;LINKAGE=B

$$\frac{\Gamma(\eta_c(1S) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}}{\Gamma_{39}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}}$$

NODE=M026R78
NODE=M026R78

VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

9.7±2.5±0.7	33	¹ ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta \pi^+ \pi^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R78;LINKAGE=A

$$\frac{\Gamma(\eta_c(1S) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}}{\Gamma_{39}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}}$$

NODE=M026R79
NODE=M026R79

VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

4.2±0.9 OUR AVERAGE

4.6±1.1	75	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
3.1±1.1±1.5	18	PARTRIDGE	80B CBAL	$J/\psi \rightarrow \eta\pi^+\pi^-\gamma$

$$\frac{\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}}{\Gamma_{40}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}}$$

NODE=M026R81
NODE=M026R81

VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

2.6±0.7±0.2	39	¹ ABLIKIM	12N	BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+\pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+\pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R81;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{41} / \Gamma \times \Gamma_{237}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.17±0.26 OUR FIT		Error includes scale factor of 2.0.		
1.9 ±0.6 OUR AVERAGE		Error includes scale factor of 2.4.		
1.5 ±0.2 ±0.2	0.4k	BAI	04	BES $J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
2.7 ±0.4	110	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R84
NODE=M026R84

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{41} / \Gamma \times \Gamma_{182}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
3.0±0.8 OUR FIT	Error includes scale factor of 1.7.		
4.0+6.0 -2.5	HIMEL	80B	MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R85
NODE=M026R85

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{41} / \Gamma \times \Gamma_{25}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.0±1.0 OUR FIT		Error includes scale factor of 1.7.		
5.6±1.3±0.4	38	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^+ \pi^-$

NODE=M026R83
NODE=M026R83

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R83;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{43} / \Gamma \times \Gamma_{25}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
3.2±0.8±0.2	^{1,2} ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma K_S^0 K^\mp \pi^\mp 2\pi^\pm$

NODE=M026R86
NODE=M026R86

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma \eta_c) \cdot B(h_c \rightarrow K_S^0 K^- \pi^- 2\pi^+) = (12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.

NODE=M026R86;LINKAGE=A

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R86;LINKAGE=B

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{44} / \Gamma \times \Gamma_{237}^{J/\psi(1S)} / \Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.21±0.32±0.24	100	ABLIKIM	06A	BES2 $J/\psi \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M026R88
NODE=M026R88

$$\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{44} / \Gamma \times \Gamma_{25}^{h_c(1P)} / \Gamma_{h_c(1P)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.8±2.5±0.3	10	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- 2(\pi^+ \pi^-)$

NODE=M026R87
NODE=M026R87

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P) \pi^0)] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P) \pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R87;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-)) / \Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+) / \Gamma_{\text{total}}$$

$$\Gamma_{45} / \Gamma \times \Gamma_{253}^{B^\pm} / \Gamma_{B^\pm}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.6±0.4 OUR FIT		Error includes scale factor of 1.4.		
1.8+0.6 -0.5	14.5+4.6 -3.0	HUANG	03	BELL $B^+ \rightarrow 2(K^+ K^-) K^+$

NODE=M026R90
NODE=M026R90

$$\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{45}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.85±0.24 OUR FIT Error includes scale factor of 1.3.

1.3 ±0.5 ±0.1 7 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(K^+ K^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(K^+ K^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R89
NODE=M026R89

NODE=M026R89;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{47}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

2.7±0.5±0.2 118 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \pi^+ \pi^- 2\pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R91
NODE=M026R91

NODE=M026R91;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

1.35±0.19 OUR FIT Error includes scale factor of 1.3.

1.36±0.23 OUR AVERAGE

1.3 ±0.2 ±0.4 0.5k BAI 04 BES $J/\psi \rightarrow \gamma 2(\pi^+ \pi^-)$

1.33±0.22±0.20 137 BISELLO 91 DM2 $J/\psi \rightarrow \gamma 2(\pi^+ \pi^-)$

1.6 ±0.6 25 BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \gamma \eta_c$

NODE=M026R93
NODE=M026R93

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT

3.4±0.7 OUR FIT Error includes scale factor of 1.3.

**5.7+3.9
-2.4** HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026R94
NODE=M026R94

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

0.57±0.09 OUR FIT Error includes scale factor of 1.3.

1.01±0.19±0.07 100 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+ \pi^-)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R92
NODE=M026R92

NODE=M026R92;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{49}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT

10.1±1.7±0.7 175 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma 2(\pi^+ \pi^- \pi^0)$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+ \pi^- \pi^0))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R95
NODE=M026R95

NODE=M026R95;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{50}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.59±0.32±0.47 471 ABLIKIM 06A BES2 $J/\psi \rightarrow 3(\pi^+ \pi^-) \gamma$

NODE=M026R97
NODE=M026R97

$$\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{50}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.19±0.30±0.08	51	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma 3(\pi^+ \pi^-)$

NODE=M026R96
NODE=M026R96

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R96;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

1.88±0.18 OUR FIT Error includes scale factor of 1.2.

1.61±0.29 OUR AVERAGE

1.9 ±0.3 ±0.3	213	BAI	04 BES	$J/\psi \rightarrow \gamma p\bar{p}$
1.3 ±0.4 ±0.3	18	BISELLO	91 DM2	$J/\psi \rightarrow \gamma p\bar{p}$
1.4 ±0.7	23	BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

NODE=M026R99
NODE=M026R99

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

8.0±0.8 OUR FIT

8.7±2.9±0.6 15 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R98
NODE=M026R98

NODE=M026R98;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{182}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT

4.8±0.7 OUR FIT Error includes scale factor of 1.2.

8 +8 -4 HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$

NODE=M026P00
NODE=M026P00

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma \times \Gamma_{253}^{B^+}/\Gamma_{B^+}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

1.47±0.12 OUR FIT Error includes scale factor of 1.1.

1.54±0.19 OUR AVERAGE Error includes scale factor of 1.1.

1.42±0.11 ^{+0.16} _{-0.20}	195	WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+$
1.8 ^{+0.3} _{-0.2} ±0.2		AUBERT,B	05L BABR	$e^+ e^- \rightarrow \gamma(4S)$

NODE=M026P01
NODE=M026P01

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{52}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.1±0.7±0.1 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026P02
NODE=M026P02

NODE=M026P02;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \quad \Gamma_{53}/\Gamma \times \Gamma_{25}^{h_c(1P)}/\Gamma_{h_c(1P)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

2.19±0.30 OUR FIT

3.1 ±1.0 ±0.2 19 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma p\bar{p}\pi^+ \pi^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.30 \pm 0.65 \pm 0.36) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026P07
NODE=M026P07

NODE=M026P07;LINKAGE=A

$$\Gamma(\eta_c(1S) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}}$$

$$\Gamma_{53}/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

4.0 ± 0.4 OUR FIT

3.94 $^{+0.41+0.22}_{-0.39-0.18}$

CHILIKIN

19

BELL

$e^+e^- \rightarrow \gamma(4S)$

NODE=M026R82
NODE=M026R82

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{54}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

1.5 ± 0.4 OUR FIT Error includes scale factor of 1.5.

1.98 $\pm 0.21 \pm 0.32$

ABLIKIM

12B

BES3

$J/\psi \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M026P03
NODE=M026P03

$$\Gamma(\eta_c(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}}$$

$$\Gamma_{54}/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

1.21 ± 0.30 OUR FIT Error includes scale factor of 1.5.

0.95 $^{+0.25+0.08}_{-0.22-0.11}$

20

WU

06

BELL

$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$

NODE=M026P04
NODE=M026P04

$$\Gamma(\eta_c(1S) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{57}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.60 $\pm 0.48 \pm 0.31$ 112 ABLIKIM 13C BES3 $J/\psi \rightarrow \gamma p\bar{p}\pi^0\pi^0$

NODE=M026P05
NODE=M026P05

$$\Gamma(\eta_c(1S) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

1.51 $\pm 0.27 \pm 0.14$ 78 ABLIKIM 13C BES3 $J/\psi \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M026P06
NODE=M026P06

$$\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(J/\psi(1S) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{59}/\Gamma \times \Gamma_{237}^{J/\psi(1S)}/\Gamma_{J/\psi(1S)}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

2.34 ± 0.35 OUR FIT Error includes scale factor of 1.2.

3.8 $^{+1.3}_{-1.0}$ OUR AVERAGE Error includes scale factor of 1.1.

4.5 $\pm 1.2 \pm 0.6$

ABLIKIM

13I

BES3

1.2 $^{+2.7}_{-1.1} \pm 0.3$ 1.2 $^{+2.8}_{-1.1}$

ADAMS

08

CLEO

$\psi(2S) \rightarrow \pi^+\pi^-J/\psi$

NODE=M026P08
NODE=M026P08

$$\Gamma(\eta_c(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(B^+ \rightarrow \eta_c K^+)/\Gamma_{\text{total}}$$

$$\Gamma_{59}/\Gamma \times \Gamma_{253}^{B^\pm}/\Gamma^{B^\pm}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

0.183 ± 0.022 OUR FIT Error includes scale factor of 1.2.

0.22 $^{+0.09+0.04}_{-0.07-0.02}$

13

WICHT

08

BELL

$B^\pm \rightarrow K^\pm\gamma\gamma$

NODE=M026P09
NODE=M026P09

$\eta_c(1S)$ REFERENCES

NODE=M026

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	21A	PR D104 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	20H	EPJ C80 191	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	19AP	PR D100 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AV	PR D100 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
CHILIKIN	19	PR D100 012001	K. Chilikin <i>et al.</i>	(BESIII Collab.)
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BESIII Collab.)
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BESIII Collab.)
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17P	PR D95 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	16A	PR D93 012005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	13C	PR D87 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12F	PRL 108 222002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BESIII Collab.)
ZHANG	12A	PR D86 052002	C.C. Zhang <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11G	PR D84 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)

REFID=62349
REFID=61030
REFID=61442
REFID=60419
REFID=59901
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REFID=59899
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REFID=55592
REFID=54267
REFID=54271
REFID=54741
REFID=54303
REFID=54763
REFID=53711

DEL-AMO-SA...11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA 11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
LEES 10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53236
MITCHELL 09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
ADAMS 08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT 08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
UEHARA 08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT 08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE 07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ABLIKIM 06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50987
ABLIKIM 06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50988
AUBERT 06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
PDG 06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
WU 06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM 05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50837
AUBERT,B 05L	PR D72 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50827
KUO 05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)	REFID=50801
ABE 04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM 04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
ASNER 04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT 04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
AUBERT,B 04B	PR D70 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50043
BAI 04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
ABDALLAH 03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49625
AMBROGIANI 03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=49465
BAI 03	PL B555 174	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49185
FANG 03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)	REFID=49206
HUANG 03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
ABE,K 02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAI 00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48546
BRANDENB... 00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)	REFID=48553
ACCIARRI 99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=47476
BAI 99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ABREU 98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46553
SHIRAI 98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)	REFID=46381
ARMSTRONG 95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=44623
ALBRECHT 94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44098
ADRIANI 93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)	REFID=43670
BISELLO 91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41668
BAI 90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
CHEN 90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)	REFID=41360
BAGLIN 89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)	REFID=41015
BEHREND 89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40732
BRAUNSCH... 89	ZPHY C41 533	W. Braunschweig <i>et al.</i>	(TASSO Collab.)	REFID=40728
AIHARA 88D	PRL 60 2355	H. Aihara <i>et al.</i>	(TPC Collab.)	REFID=40588
BAGLIN 87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BALTRUSAIT... 86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
BERGER 86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=22010
GAISER 86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
ALTHOFF 85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21349
BALTRUSAIT... 84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+) JP	REFID=22006
BLOOM 83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
HIMEL 80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)	REFID=22003
PARTRIDGE 80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22004

$J/\psi(1S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M070

 $J/\psi(1S)$ MASS

NODE=M070M

NODE=M070M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3096.900±0.006 OUR AVERAGE				
3096.900±0.002±0.006		¹ ANASHIN 15	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3096.89 ±0.09	502	² ARTAMONOV 00	OLYA	$e^+e^- \rightarrow \text{hadrons}$
3096.91 ±0.03 ±0.01		³ ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
3096.95 ±0.1 ±0.3	193	BAGLIN 87	SPEC	$\bar{p}p \rightarrow e^+e^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3096.66 ±0.19 ±0.02	6.1k	⁴ AAIJ 15Bl	LHCB	$pp \rightarrow J/\psi X$
3096.917±0.010±0.007		AULCHENKO 03	KEDR	$e^+e^- \rightarrow \text{hadrons}$
3097.5 ±0.3		GRIBUSHIN 96	FMPS	$515 \pi^- \text{Be} \rightarrow 2\mu X$
3098.4 ±2.0	38k	LEMOIGNE 82	GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3096.93 ±0.09	502	⁵ ZHOLENTZ 80	REDE	e^+e^-
3097.0 ±1		⁶ BRANDELIK 79c	DASP	e^+e^-

¹Supersedes AULCHENKO 03.²Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).³Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.⁴From a sample of $\eta_c(1S)$ and J/ψ produced in b -hadron decays. Systematic uncertainties not estimated.⁵Superseded by ARTAMONOV 00.⁶From a simultaneous fit to e^+e^- , $\mu^+\mu^-$ and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M070M;LINKAGE=A

NODE=M070M;LINKAGE=AR

NODE=M070M;LINKAGE=NW

NODE=M070M;LINKAGE=B

NODE=M070M;LINKAGE=RZ

NODE=M070M;LINKAGE=F

 $J/\psi(1S)$ WIDTH

NODE=M070W

NODE=M070W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
92.6 ± 1.7 OUR AVERAGE				
Error includes scale factor of 1.1.				
92.45 ± 1.40±1.48		¹ ANASHIN 20	KEDR	e^+e^-
96.1 ± 3.2	13k	² ADAMS 06A	CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
84.4 ± 8.9		BAI 95B	BES	e^+e^-
91 ±11 ±6		³ ARMSTRONG 93B	E760	$\bar{p}p \rightarrow e^+e^-$
85.5 + 6.1 - 5.8		⁴ HSUEH 92	RVUE	See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
92.94 ± 1.83		^{5,6} ANASHIN 18A	KEDR	e^+e^-
94.1 ± 2.7		⁷ ANASHIN 10	KEDR	$3.097 e^+e^- \rightarrow e^+e^-, \mu^+\mu^-$
93.7 ± 3.5	7.8k	² AUBERT 04	BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$

¹Based on the same dataset as ANASHIN 18A and correlated to the values reported there²Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(e^+e^-) = (5.94 \pm 0.06)\%$ and $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.³The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].⁴Using data from COFFMAN 92, BALDINI-CELIO 75, BOYARSKI 75, ESPOSITO 75B, BRANDELIK 79C.⁵Using $\Gamma(e^+e^-)$ from ANASHIN 18A and $B(J/\psi(1S) \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ from PDG 16.⁶Superseded by ANASHIN 20 that is based on the same dataset .⁷Assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$ and using $\Gamma(e^+e^-)/\Gamma_{\text{total}} = (5.94 \pm 0.06)\%$.

NODE=M070W;LINKAGE=C

NODE=M070W;LINKAGE=AA

NODE=M070W;LINKAGE=AN

NODE=M070W;LINKAGE=A

NODE=M070W;LINKAGE=B

NODE=M070W;LINKAGE=D

NODE=M070W;LINKAGE=AS

 $J/\psi(1S)$ DECAY MODES

NODE=M070215;NODE=M070

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 hadrons	(87.7 ± 0.5) %	DESIG=3
Γ_2 virtual $\gamma \rightarrow \text{hadrons}$	(13.46 ± 0.07) %	DESIG=4
Γ_3 ggg	(64.1 ± 1.0) %	DESIG=249
Γ_4 γgg	(8.8 ± 1.1) %	DESIG=250
Γ_5 e^+e^-	(5.971± 0.032) %	DESIG=1
Γ_6 $e^+e^-\gamma$	[a] (8.8 ± 1.4) × 10 ⁻³	DESIG=5
Γ_7 $\mu^+\mu^-$	(5.961± 0.033) %	DESIG=2

Decays involving hadronic resonances

				NODE=M070;CLUMP=A
Γ ₈	$\rho\pi$	(1.88 ± 0.12) %	S=2.6	DESIG=20
Γ ₉	$\rho^0\pi^0$	(6.2 ± 0.6) × 10 ⁻³		DESIG=21
Γ ₁₀	$a_2(1320)^0\pi^+\pi^-\rightarrow 2(\pi^+\pi^-)\pi^0$	(2.8 ± 0.6) × 10 ⁻³		DESIG=442
Γ ₁₁	$a_2(1320)^+\pi^-\pi^0 + \text{c.c.} \rightarrow 2(\pi^+\pi^-)\pi^0$	(3.7 ± 0.7) × 10 ⁻³		DESIG=443
Γ ₁₂	$a_2(1320)\rho$	(1.09 ± 0.22) %		DESIG=43
Γ ₁₃	$\eta\pi^+\pi^-$	(3.8 ± 0.7) × 10 ⁻⁴		DESIG=239
Γ ₁₄	$\eta\rho$	(1.93 ± 0.23) × 10 ⁻⁴		DESIG=22
Γ ₁₅	$\eta\pi^+\pi^-\pi^0$	(1.17 ± 0.20) %		DESIG=420
Γ ₁₆	$\eta\pi^+\pi^-3\pi^0$	(4.9 ± 1.0) × 10 ⁻³		DESIG=422
Γ ₁₇	$\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$	(1.2 ± 0.4) × 10 ⁻⁴		DESIG=287
Γ ₁₈	$\eta\phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0$	< 2.52 × 10 ⁻⁴	CL=90%	DESIG=253
Γ ₁₉	$\eta K^+ K^-$	(8.6 ± 3.0) × 10 ⁻⁴		DESIG=455
Γ ₂₀	$\eta K^\pm K_S^0 \pi^\mp$	[b] (2.2 ± 0.4) × 10 ⁻³		DESIG=230
Γ ₂₁	$\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 ± 0.26) × 10 ⁻³		DESIG=252
Γ ₂₂	$\rho\eta'(958)$	(8.1 ± 0.8) × 10 ⁻⁵	S=1.6	DESIG=23
Γ ₂₃	$\rho^\pm\pi^\mp\pi^+\pi^-2\pi^0$	(2.8 ± 0.8) %		DESIG=415
Γ ₂₄	$\rho^+\rho^-\pi^+\pi^-\pi^0$	(6 ± 4) × 10 ⁻³		DESIG=416
Γ ₂₅	$\rho^+ K^+ K^- \pi^- + \text{c.c.} \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 ± 0.8) × 10 ⁻³		DESIG=444
Γ ₂₆	$\rho^\mp K^\pm K_S^0$	(1.9 ± 0.4) × 10 ⁻³		DESIG=342
Γ ₂₇	$h_1(1415)\eta' \rightarrow \gamma\eta\eta'$			DESIG=435
Γ ₂₈	$h_1(1595)\eta' \rightarrow \gamma\eta\eta'$			DESIG=437
Γ ₂₉	$\rho(1450)\pi$	seen		DESIG=310;OUR EST;→ UNCHECKED ←
Γ ₃₀	$\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.2 ± 1.1) × 10 ⁻⁴		DESIG=328
Γ ₃₁	$\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp$	(3.3 ± 0.6) × 10 ⁻⁴		DESIG=329
Γ ₃₂	$\rho(1450)^0\pi^0 \rightarrow K^+ K^- \pi^0$	(2.7 ± 0.6) × 10 ⁻⁴		DESIG=312
Γ ₃₃	$\rho(1450)\eta'(958) \rightarrow \pi^+\pi^-\eta'(958)$	(3.3 ± 0.7) × 10 ⁻⁶		DESIG=345
Γ ₃₄	$\rho(1700)\pi$	seen		DESIG=325;OUR EST;→ UNCHECKED ←
Γ ₃₅	$\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0$	(1.6 ± 1.1) × 10 ⁻⁴		DESIG=313
Γ ₃₆	$\rho(2150)\pi$	seen		DESIG=326;OUR EST;→ UNCHECKED ←
Γ ₃₇	$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	(10 ± 40) × 10 ⁻⁶		DESIG=314
Γ ₃₈	$\rho_3(1690)\pi \rightarrow \pi^+\pi^-\pi^0$			DESIG=316
Γ ₃₉	$\omega\pi^0$	(4.5 ± 0.5) × 10 ⁻⁴	S=1.4	DESIG=32
Γ ₄₀	$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0$	(1.6 ± 0.7) × 10 ⁻⁵		DESIG=327
Γ ₄₁	$\omega\pi^+\pi^-$	(8.5 ± 1.0) × 10 ⁻³	S=1.3	DESIG=24
Γ ₄₂	$\omega\pi^0\pi^0$	(3.4 ± 0.8) × 10 ⁻³		DESIG=140
Γ ₄₃	$\omega 3\pi^0$	(1.9 ± 0.6) × 10 ⁻³		DESIG=421
Γ ₄₄	$\omega f_2(1270)$	(4.3 ± 0.6) × 10 ⁻³		DESIG=28
Γ ₄₅	$\omega\eta$	(1.74 ± 0.20) × 10 ⁻³	S=1.6	DESIG=30
Γ ₄₆	$\omega\pi^+\pi^-\pi^0$	(4.0 ± 0.7) × 10 ⁻³		DESIG=211
Γ ₄₇	$\omega\pi^0\eta$	(3.4 ± 1.7) × 10 ⁻⁴		DESIG=360
Γ ₄₈	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 ± 3.4) × 10 ⁻³		DESIG=26
Γ ₄₉	$\omega\pi^+\pi^-2\pi^0$	(3.3 ± 0.5) %		DESIG=412
Γ ₅₀	$\omega\eta'\pi^+\pi^-$	(1.12 ± 0.13) × 10 ⁻³		DESIG=385
Γ ₅₁	$\omega\eta'(958)$	(1.89 ± 0.18) × 10 ⁻⁴		DESIG=31
Γ ₅₂	$\omega f_0(980)$	(1.4 ± 0.5) × 10 ⁻⁴		DESIG=150
Γ ₅₃	$\omega f_0(1710) \rightarrow \omega K \bar{K}$	(4.8 ± 1.1) × 10 ⁻⁴		DESIG=130
Γ ₅₄	$\omega f_1(1420)$	(6.8 ± 2.4) × 10 ⁻⁴		DESIG=105
Γ ₅₅	$\omega f_2'(1525)$	< 2.2 × 10 ⁻⁴	CL=90%	DESIG=29
Γ ₅₆	$\omega X(1835) \rightarrow \omega p \bar{p}$	< 3.9 × 10 ⁻⁶	CL=95%	DESIG=263
Γ ₅₇	$\omega X(1835), X \rightarrow \eta'\pi^+\pi^-$	< 6.2 × 10 ⁻⁵		DESIG=386
Γ ₅₈	$\omega K^+ K^-$	(1.52 ± 0.31) × 10 ⁻³		DESIG=441
Γ ₅₉	$\omega K^\pm K_S^0 \pi^\mp$	[b] (3.4 ± 0.5) × 10 ⁻³		DESIG=101
Γ ₆₀	$\omega K \bar{K}$	(1.9 ± 0.4) × 10 ⁻³		DESIG=27
Γ ₆₁	$\omega K^*(892) \bar{K} + \text{c.c.}$	(6.1 ± 0.9) × 10 ⁻³		DESIG=102

Г ₆₂	$\eta' K^{*\pm} K^\mp$	$(1.48 \pm 0.13) \times 10^{-3}$		DESIG=355
Г ₆₃	$\eta' K^{*0} \bar{K}^0 + \text{c.c.}$	$(1.66 \pm 0.21) \times 10^{-3}$		DESIG=357
Г ₆₄	$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.}$	$(2.16 \pm 0.31) \times 10^{-4}$		DESIG=353
Г ₆₅	$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	$(1.51 \pm 0.23) \times 10^{-4}$		DESIG=354
Г ₆₆	$\eta' h_1(1415) \rightarrow \gamma \eta' \eta'$	$(4.7 \pm \frac{1.1}{2.0}) \times 10^{-7}$		DESIG=430
Г ₆₇	$\bar{K} K^*(892) + \text{c.c.}$	seen		DESIG=331;OUR EST;→ UNCHECKED ←
Г ₆₈	$\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	$(4.8 \pm 0.5) \times 10^{-3}$		DESIG=332
Г ₆₉	$K^+ K^*(892)^- + \text{c.c.}$	$(6.0 \pm \frac{0.8}{1.0}) \times 10^{-3}$	S=2.9	DESIG=121
Г ₇₀	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(2.69 \pm \frac{0.13}{0.20}) \times 10^{-3}$		DESIG=231
Г ₇₁	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$	$(3.0 \pm 0.4) \times 10^{-3}$		DESIG=232
Г ₇₂	$K^0 \bar{K}^*(892)^0 + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-3}$		DESIG=122
Г ₇₃	$K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$	$(3.2 \pm 0.4) \times 10^{-3}$		DESIG=233
Г ₇₄	$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	$(5.7 \pm 0.8) \times 10^{-3}$		DESIG=214
Г ₇₅	$K^*(892)^\pm K^\mp \pi^0$	$(4.1 \pm 1.3) \times 10^{-3}$		DESIG=343
Г ₇₆	$K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$(2.0 \pm 0.5) \times 10^{-3}$		DESIG=299
Г ₇₇	$K^*(892)^+ K_S^0 \pi^- + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$	$(6.7 \pm 2.2) \times 10^{-4}$		DESIG=300
Г ₇₈	$K^*(892)^0 K^- \pi^+ + \text{c.c.} \rightarrow K^+ K^- \pi^+ \pi^-$	$(3.8 \pm 0.5) \times 10^{-3}$		DESIG=445
Г ₇₉	$K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(6.3 \pm \frac{0.6}{0.5}) \times 10^{-6}$		DESIG=376
Г ₈₀	$K^*(892)^0 K_S^0 \pi^0$	$(7 \pm 4) \times 10^{-4}$		DESIG=344
Г ₈₁	$K^*(892)^\pm K^*(700)^\mp$	$(1.1 \pm \frac{1.0}{0.6}) \times 10^{-3}$		DESIG=257
Г ₈₂	$K^*(892)^0 \bar{K}^*(892)^0$	$(2.3 \pm 0.6) \times 10^{-4}$		DESIG=46
Г ₈₃	$K^*(892)^\pm K^*(892)^\mp$	$(1.00 \pm \frac{0.22}{0.40}) \times 10^{-3}$		DESIG=256
Г ₈₄	$K_1(1400)^\pm K^\mp$	$(3.8 \pm 1.4) \times 10^{-3}$		DESIG=132
Г ₈₅	$K^*(1410) \bar{K} + \text{c.c.}$	seen		DESIG=317;OUR EST;→ UNCHECKED ←
Г ₈₆	$K^*(1410) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0$	$(7 \pm 4) \times 10^{-5}$		DESIG=330
Г ₈₇	$K^*(1410) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	$(8 \pm 5) \times 10^{-5}$		DESIG=318
Г ₈₈	$K_2^*(1430) \bar{K} + \text{c.c.}$	seen		DESIG=319;OUR EST;→ UNCHECKED ←
Г ₈₉	$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0$	$(1.0 \pm 0.5) \times 10^{-4}$		DESIG=321
Г ₉₀	$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=320
Г ₉₁	$\bar{K}_2^*(1430) K + \text{c.c.}$	$< 4.0 \times 10^{-3}$	CL=90%	DESIG=45
Г ₉₂	$K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(2.69 \pm \frac{0.25}{0.19}) \times 10^{-4}$		DESIG=381
Г ₉₃	$K_2^*(1430)^0 K^- \pi^+ + \text{c.c.} \rightarrow K^+ K^- \pi^+ \pi^-$	$(2.6 \pm 0.9) \times 10^{-3}$		DESIG=446
Г ₉₄	$K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}$	$(3.6 \pm 1.8) \times 10^{-3}$		DESIG=301
Г ₉₅	$\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}$	$(4.67 \pm 0.29) \times 10^{-3}$		DESIG=48
Г ₉₆	$K_2^*(1430)^- K^*(892)^+ + \text{c.c.}$	$(3.4 \pm 2.9) \times 10^{-3}$		DESIG=303
Г ₉₇	$K_2^*(1430)^- K^*(892)^+ + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$(4 \pm 4) \times 10^{-4}$		DESIG=304
Г ₉₈	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90%	DESIG=47
Г ₉₉	$\bar{K}_2(1770)^0 K^*(892)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(6.9 \pm 0.9) \times 10^{-4}$		DESIG=235
Г ₁₀₀	$K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(1.10 \pm \frac{0.60}{0.14}) \times 10^{-5}$		DESIG=382

Γ ₁₀₁	$K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	$(6.2 \pm 2.9) \times 10^{-6}$		DESIG=383
Γ ₁₀₂	$K_1(1270)^\pm K^\mp$	< 3.0	$\times 10^{-3}$	CL=90% DESIG=131
Γ ₁₀₃	$K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5) \times 10^{-7}$		DESIG=377
Γ ₁₀₄	$a_2(1320)^\pm \pi^\mp$	$[b] < 4.3$	$\times 10^{-3}$	CL=90% DESIG=42
Γ ₁₀₅	$\phi \pi^0$	$3 \times 10^{-6} \text{ or } 1 \times 10^{-7}$		DESIG=33; OUR EVAL; → UNCHECKED ←
Γ ₁₀₆	$\phi \pi^+ \pi^-$	$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	DESIG=34
Γ ₁₀₇	$\phi \pi^0 \pi^0$	$(5.0 \pm 1.0) \times 10^{-4}$		DESIG=76
Γ ₁₀₈	$\phi 2(\pi^+ \pi^-)$	$(1.60 \pm 0.32) \times 10^{-3}$		DESIG=35
Γ ₁₀₉	$\phi \eta$	$(7.4 \pm 0.6) \times 10^{-4}$	S=1.2	DESIG=37
Γ ₁₁₀	$\phi \eta'(958)$	$(4.6 \pm 0.5) \times 10^{-4}$	S=2.2	DESIG=38
Γ ₁₁₁	$\phi \eta \eta'$	$(2.32 \pm 0.17) \times 10^{-4}$		DESIG=387
Γ ₁₁₂	$\phi f_0(980)$	$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=41
Γ ₁₁₃	$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	$(2.60 \pm 0.34) \times 10^{-4}$		DESIG=236
Γ ₁₁₄	$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$	$(1.8 \pm 0.5) \times 10^{-4}$		DESIG=237
Γ ₁₁₅	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(4.5 \pm 1.0) \times 10^{-6}$		DESIG=278
Γ ₁₁₆	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \rho^0 \pi^0$	$(1.7 \pm 0.6) \times 10^{-6}$		DESIG=279
Γ ₁₁₇	$\phi f_0(980) \eta \rightarrow \eta \phi \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=229
Γ ₁₁₈	$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$	$(4.4 \pm 1.4) \times 10^{-6}$		DESIG=258
Γ ₁₁₉	$\phi f_2(1270)$	$(3.2 \pm 0.6) \times 10^{-4}$		DESIG=39
Γ ₁₂₀	$\phi f_1(1285)$	$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=106
Γ ₁₂₁	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(9.4 \pm 2.8) \times 10^{-7}$		DESIG=280
Γ ₁₂₂	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0$	$(2.1 \pm 2.2) \times 10^{-7}$		DESIG=281
Γ ₁₂₃	$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$		DESIG=128
Γ ₁₂₄	$\phi f'_2(1525)$	$(8 \pm 4) \times 10^{-4}$	S=2.7	DESIG=40
Γ ₁₂₅	$\phi X(1835) \rightarrow \phi p \bar{p}$	< 2.1	$\times 10^{-7}$	CL=90% DESIG=291
Γ ₁₂₆	$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	< 2.8	$\times 10^{-4}$	CL=90% DESIG=288
Γ ₁₂₇	$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	< 6.13	$\times 10^{-5}$	CL=90% DESIG=289
Γ ₁₂₈	$\phi K \bar{K}$	$(1.77 \pm 0.16) \times 10^{-3}$	S=1.3	DESIG=36
Γ ₁₂₉	$\phi f_0(1710) \rightarrow \phi K \bar{K}$	$(3.6 \pm 0.6) \times 10^{-4}$		DESIG=129
Γ ₁₃₀	$\phi K^+ K^-$	$(8.3 \pm 1.1) \times 10^{-4}$		DESIG=295
Γ ₁₃₁	$\phi K_S^0 K_S^0$	$(5.9 \pm 1.5) \times 10^{-4}$		DESIG=305
Γ ₁₃₂	$\phi K^\pm K_S^0 \pi^\mp$	$[b] (7.2 \pm 0.8) \times 10^{-4}$		DESIG=103
Γ ₁₃₃	$\phi K^*(892) \bar{K} + \text{c.c.}$	$(2.18 \pm 0.23) \times 10^{-3}$		DESIG=104
Γ ₁₃₄	$b_1(1235)^\pm \pi^\mp$	$[b] (3.0 \pm 0.5) \times 10^{-3}$		DESIG=49
Γ ₁₃₅	$b_1(1235)^0 \pi^0$	$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=160
Γ ₁₃₆	$f'_2(1525) K^+ K^-$	$(1.04 \pm 0.35) \times 10^{-3}$		DESIG=308
Γ ₁₃₇	$\Delta(1232)^+ \bar{p}$	< 1	$\times 10^{-4}$	CL=90% DESIG=112
Γ ₁₃₈	$\Delta(1232)^{++} \bar{p} \pi^-$	$(1.6 \pm 0.5) \times 10^{-3}$		DESIG=70
Γ ₁₃₉	$\Delta(1232)^{++} \Delta(1232)^{--}$	$(1.10 \pm 0.29) \times 10^{-3}$		DESIG=66
Γ ₁₄₀	$\bar{\Sigma}(1385)^0 p K^-$	$(5.1 \pm 3.2) \times 10^{-4}$		DESIG=74
Γ ₁₄₁	$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	< 8.2	$\times 10^{-6}$	CL=90% DESIG=111
Γ ₁₄₂	$\Sigma(1385)^- \bar{\Sigma}^+ + \text{c.c.}$	$[b] (3.0 \pm 0.7) \times 10^{-4}$		DESIG=68
Γ ₁₄₃	$\Sigma(1385)^+ \bar{\Sigma}^- + \text{c.c.}$	$(3.3 \pm 0.8) \times 10^{-4}$		DESIG=450
Γ ₁₄₄	$\Sigma(1385)^- \bar{\Sigma}(1385)^+ + \text{c.c.}$	$[b] (1.08 \pm 0.06) \times 10^{-3}$		DESIG=67
Γ ₁₄₅	$\Sigma(1385)^+ \bar{\Sigma}(1385)^- + \text{c.c.}$	$(1.25 \pm 0.07) \times 10^{-3}$		DESIG=451
Γ ₁₄₆	$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(1.07 \pm 0.08) \times 10^{-3}$		DESIG=309
Γ ₁₄₇	$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	< 4.1	$\times 10^{-6}$	CL=90% DESIG=260
Γ ₁₄₈	$\bar{\Lambda}(1520) \Lambda + \text{c.c.}$	< 1.80	$\times 10^{-3}$	CL=90% DESIG=364
Γ ₁₄₉	$\Xi^0 \Xi^0$	$(1.17 \pm 0.04) \times 10^{-3}$		DESIG=248
Γ ₁₅₀	$\Xi(1530)^- \Xi^+ + \text{c.c.}$	$(3.18 \pm 0.08) \times 10^{-4}$		DESIG=107
Γ ₁₅₁	$\Xi(1530)^0 \Xi^0$	$(3.2 \pm 1.4) \times 10^{-4}$		DESIG=108
Γ ₁₅₂	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$[c] < 1.1$	$\times 10^{-5}$	CL=90% DESIG=205
Γ ₁₅₃	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$[c] < 2.1$	$\times 10^{-5}$	CL=90% DESIG=206
Γ ₁₅₄	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$[c] < 1.6$	$\times 10^{-5}$	CL=90% DESIG=207
Γ ₁₅₅	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$[c] < 5.6$	$\times 10^{-5}$	CL=90% DESIG=208
Γ ₁₅₆	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$[c] < 1.1$	$\times 10^{-5}$	CL=90% DESIG=209

Decays into stable hadrons

NODE=M070;CLUMP=B

Γ ₁₅₇	$2(\pi^+\pi^-\pi^0)$	(4.2 ± 0.4) %	S=2.1	DESIG=9
Γ ₁₅₈	$3(\pi^+\pi^-\pi^0)$	(2.9 ± 0.6) %		DESIG=11
Γ ₁₅₉	$\pi^+\pi^-3\pi^0$	(1.9 ± 0.9) %		DESIG=358
Γ ₁₆₀	$\rho^\pm\pi^\mp\pi^0\pi^0$	(1.41 ± 0.22) %		DESIG=362
Γ ₁₆₁	$\rho^+\rho^-\pi^0$	(6.0 ± 1.1) × 10 ⁻³		DESIG=363
Γ ₁₆₂	$\pi^+\pi^-4\pi^0$	(6.5 ± 1.3) × 10 ⁻³		DESIG=419
Γ ₁₆₃	$\pi^+\pi^-\pi^0$	(2.00 ± 0.07) %	S=2.0	DESIG=7
Γ ₁₆₄	$2(\pi^+\pi^-\pi^0)$	(1.61 ± 0.20) %		DESIG=210
Γ ₁₆₅	$\pi^+\pi^-\pi^0K^+K^-$	(1.52 ± 0.27) %	S=1.4	DESIG=18
Γ ₁₆₆	$\pi^+\pi^-$	(1.47 ± 0.14) × 10 ⁻⁴		DESIG=6
Γ ₁₆₇	$2(\pi^+\pi^-)$	(3.20 ± 0.25) × 10 ⁻³	S=1.2	DESIG=8
Γ ₁₆₈	$3(\pi^+\pi^-)$	(4.3 ± 0.4) × 10 ⁻³		DESIG=10
Γ ₁₆₉	$2(\pi^+\pi^-)3\pi^0$	(6.2 ± 0.9) %		DESIG=411
Γ ₁₇₀	$4(\pi^+\pi^-)\pi^0$	(9.0 ± 3.0) × 10 ⁻³		DESIG=12
Γ ₁₇₁	$2(\pi^+\pi^-)\eta$	(2.29 ± 0.28) × 10 ⁻³		DESIG=201
Γ ₁₇₂	$3(\pi^+\pi^-)\eta$	(7.2 ± 1.5) × 10 ⁻⁴		DESIG=202
Γ ₁₇₃	$2(\pi^+\pi^-\pi^0)\eta$	(1.6 ± 0.5) × 10 ⁻³		DESIG=418
Γ ₁₇₄	$\pi^+\pi^-\pi^0\pi^0\eta$	(2.4 ± 0.5) × 10 ⁻³		DESIG=359
Γ ₁₇₅	$\rho^\pm\pi^\mp\pi^0\eta$	(1.9 ± 0.8) × 10 ⁻³		DESIG=361
Γ ₁₇₆	K^+K^-	(2.86 ± 0.21) × 10 ⁻⁴		DESIG=13
Γ ₁₇₇	$K_S^0K_L^0$	(1.95 ± 0.11) × 10 ⁻⁴	S=2.4	DESIG=75
Γ ₁₇₈	$K_S^0K_S^0$	< 1.4 × 10 ⁻⁸	CL=95%	DESIG=14
Γ ₁₇₉	$K\bar{K}\pi$	(6.1 ± 1.0) × 10 ⁻³		DESIG=15
Γ ₁₈₀	$K^+K^-\pi^0$	(2.88 ± 0.12) × 10 ⁻³		DESIG=334
Γ ₁₈₁	$K_S^0K^\pm\pi^\mp$	(5.3 ± 0.5) × 10 ⁻³		DESIG=335
Γ ₁₈₂	$K_S^0K_L^0\pi^0$	(2.06 ± 0.26) × 10 ⁻³		DESIG=336
Γ ₁₈₃	$K^*(892)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K_L^0\pi^0$	(1.21 ± 0.18) × 10 ⁻³		DESIG=339
Γ ₁₈₄	$K_2^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K_L^0\pi^0$	(4.3 ± 1.3) × 10 ⁻⁴		DESIG=338
Γ ₁₈₅	$K^+K^-\pi^+\pi^-$	(7.0 ± 1.0) × 10 ⁻³		DESIG=16
Γ ₁₈₆	$K^+K^-\pi^0\pi^0$	(2.13 ± 0.22) × 10 ⁻³		DESIG=234
Γ ₁₈₇	$K^+K^-\pi^0\pi^0\pi^0$	(1.61 ± 0.29) × 10 ⁻³		DESIG=452
Γ ₁₈₈	$K_S^0K^\pm\pi^\mp\pi^0\pi^0$	(5.3 ± 0.7) × 10 ⁻³		DESIG=453
Γ ₁₈₉	$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	(6.3 ± 0.4) × 10 ⁻³		DESIG=454
Γ ₁₉₀	$K_S^0K^\pm\rho(770)^\pm\pi^0$	(2.9 ± 0.8) × 10 ⁻³		DESIG=463
Γ ₁₉₁	$K_S^0K_L^0\pi^+\pi^-$	(3.8 ± 0.6) × 10 ⁻³		DESIG=296
Γ ₁₉₂	$K_S^0K_L^0\pi^0\pi^0$	(1.9 ± 0.4) × 10 ⁻³		DESIG=337
Γ ₁₉₃	$K_S^0K_L^0\eta$	(1.45 ± 0.33) × 10 ⁻³		DESIG=340
Γ ₁₉₄	$K_S^0K_S^0\pi^+\pi^-$	(1.68 ± 0.19) × 10 ⁻³		DESIG=297
Γ ₁₉₅	$K^\mp K_S^0\pi^\pm\pi^0$	(5.7 ± 0.5) × 10 ⁻³		DESIG=341
Γ ₁₉₆	$K_S^0K^\pm\pi^\mp\rho(770)^0$	(3.1 ± 0.5) × 10 ⁻³		DESIG=456
Γ ₁₉₇	$K^+K^-2(\pi^+\pi^-)$	(3.1 ± 1.3) × 10 ⁻³		DESIG=17
Γ ₁₉₈	$K^+K^-\pi^+\pi^-\eta$	(4.7 ± 0.7) × 10 ⁻³		DESIG=238
Γ ₁₉₉	$2(K^+K^-)$	(7.2 ± 0.8) × 10 ⁻⁴		DESIG=19
Γ ₂₀₀	$K^+K^-K_S^0K_S^0$	(4.2 ± 0.7) × 10 ⁻⁴		DESIG=298
Γ ₂₀₁	$K_S^0K^*(892)^0\pi^+\pi^-$	(1.7 ± 0.6) × 10 ⁻³		DESIG=457
Γ ₂₀₂	$K_S^0K^*(892)^0\pi^0\pi^0$	(1.01 ± 0.18) × 10 ⁻³		DESIG=462
Γ ₂₀₃	$K^\mp K^*(892)^\pm\pi^+\pi^-$	(3.4 ± 1.2) × 10 ⁻³		DESIG=458
Γ ₂₀₄	$K^*(892)^\pm K^*(892)^0\pi^\mp$	(4.8 ± 1.0) × 10 ⁻³		DESIG=459
Γ ₂₀₅	$K^\mp K^*(892)^\pm\pi^0\pi^0$	(1.57 ± 0.32) × 10 ⁻³		DESIG=461
Γ ₂₀₆	$K^*(892)^+K^*(892)^-\pi^0$	(1.12 ± 0.23) %		DESIG=460
Γ ₂₀₇	$p\bar{p}$	(2.120 ± 0.029) × 10 ⁻³		DESIG=50
Γ ₂₀₈	$p\bar{p}\pi^0$	(1.19 ± 0.08) × 10 ⁻³	S=1.1	DESIG=52
Γ ₂₀₉	$p\bar{p}\pi^+\pi^-$	(6.0 ± 0.5) × 10 ⁻³	S=1.3	DESIG=54
Γ ₂₁₀	$p\bar{p}\pi^+\pi^-\pi^0$	[d] (2.3 ± 0.9) × 10 ⁻³	S=1.9	DESIG=55

Γ ₂₁₁	$p\bar{p}\eta$	$(2.00 \pm 0.12) \times 10^{-3}$		DESIG=56
Γ ₂₁₂	$p\bar{p}\rho$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=57
Γ ₂₁₃	$p\bar{p}\omega$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.3	DESIG=58
Γ ₂₁₄	$p\bar{p}\eta'(958)$	$(1.29 \pm 0.14) \times 10^{-4}$	S=2.0	DESIG=59
Γ ₂₁₅	$p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta$	$(6.8 \pm 1.8) \times 10^{-5}$		DESIG=276
Γ ₂₁₆	$p\bar{p}\phi$	$(5.19 \pm 0.33) \times 10^{-5}$		DESIG=127
Γ ₂₁₇	$p\bar{n}\pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		DESIG=53
Γ ₂₁₈	$n\bar{n}$	$(2.09 \pm 0.16) \times 10^{-3}$		DESIG=64
Γ ₂₁₉	$n\bar{n}\pi^+\pi^-$	$(4 \pm 4) \times 10^{-3}$		DESIG=65
Γ ₂₂₀	$nN(1440)$	seen		DESIG=215;OUR EST;→ UNCHECKED ←
Γ ₂₂₁	$nN(1520)$	seen		DESIG=216;OUR EST;→ UNCHECKED ←
Γ ₂₂₂	$nN(1535)$	seen		DESIG=217;OUR EST;→ UNCHECKED ←
Γ ₂₂₃	$\Lambda\bar{\Lambda}$	$(1.88 \pm 0.08) \times 10^{-3}$	S=2.6	DESIG=60
Γ ₂₂₄	$\Lambda\bar{\Lambda}\pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=109
Γ ₂₂₅	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		DESIG=261
Γ ₂₂₆	$\Lambda\bar{\Lambda}\eta$	$(1.62 \pm 0.17) \times 10^{-4}$		DESIG=228
Γ ₂₂₇	$\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.}$	[b] $(1.26 \pm 0.05) \times 10^{-3}$	S=1.2	DESIG=71
Γ ₂₂₈	$\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.}$	$(1.21 \pm 0.07) \times 10^{-3}$	S=1.8	DESIG=449
Γ ₂₂₉	$pK^-\bar{\Lambda} + \text{c.c.}$	$(8.6 \pm 1.1) \times 10^{-4}$		DESIG=72
Γ ₂₃₀	$pK^-\Sigma^0$	$(2.9 \pm 0.8) \times 10^{-4}$		DESIG=73
Γ ₂₃₁	$\bar{\Lambda}nK_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		DESIG=225
Γ ₂₃₂	$\Lambda\bar{\Sigma}^+ + \text{c.c.}$	$(2.83 \pm 0.23) \times 10^{-5}$		DESIG=61
Γ ₂₃₃	$\Sigma^+\Sigma^-$	$(1.07 \pm 0.04) \times 10^{-3}$		DESIG=247
Γ ₂₃₄	$\Sigma^0\Sigma^0$	$(1.172 \pm 0.032) \times 10^{-3}$	S=1.4	DESIG=63
Γ ₂₃₅	$\Sigma^+\Sigma^-\eta$	$(6.3 \pm 0.4) \times 10^{-5}$		DESIG=448
Γ ₂₃₆	$\Xi^-\Xi^+$	$(9.7 \pm 0.8) \times 10^{-4}$	S=1.4	DESIG=62

Radiative decays

Γ ₂₃₇	$\gamma\eta_c(1S)$	$(1.41 \pm 0.14) \%$	S=1.3	NODE=M070;CLUMP=C DESIG=85
Γ ₂₃₈	$\gamma\eta_c(1S) \rightarrow 3\gamma$	seen		DESIG=246;OUR EST;→ UNCHECKED ←
Γ ₂₃₉	$\gamma\eta_c(1S) \rightarrow \gamma\eta\eta\eta'$	seen		DESIG=391;OUR EST;→ UNCHECKED ←
Γ ₂₄₀	3γ	$(1.16 \pm 0.22) \times 10^{-5}$		DESIG=81
Γ ₂₄₁	4γ	$< 9 \times 10^{-6}$	CL=90%	DESIG=244
Γ ₂₄₂	5γ	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=245
Γ ₂₄₃	$\gamma\pi^0$	$(3.39 \pm 0.08) \times 10^{-5}$		DESIG=82
Γ ₂₄₄	$\gamma\pi^0\pi^0$	$(1.15 \pm 0.05) \times 10^{-3}$		DESIG=283
Γ ₂₄₅	$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	DESIG=95
Γ ₂₄₆	$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Γ ₂₄₇	$\gamma f_2(1270) f_2(1270) (\text{non resonant})$	$(8.2 \pm 1.9) \times 10^{-4}$		DESIG=204
Γ ₂₄₈	$\gamma\pi^+\pi^-\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		DESIG=99
Γ ₂₄₉	$\gamma K_S^0 K_S^0$	$(8.1 \pm 0.4) \times 10^{-4}$		DESIG=378
Γ ₂₅₀	$\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	DESIG=176
Γ ₂₅₁	$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		DESIG=143
Γ ₂₅₂	$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		DESIG=145
Γ ₂₅₃	$\gamma\eta$	$(1.090 \pm 0.013) \times 10^{-3}$		DESIG=83
Γ ₂₅₄	$\gamma\eta\pi^0$	$(2.14 \pm 0.31) \times 10^{-5}$		DESIG=292
Γ ₂₅₅	$\gamma f_0(500) \rightarrow \gamma\pi\pi$			DESIG=398
Γ ₂₅₆	$\gamma f_0(500) \rightarrow \gamma K\bar{K}$			DESIG=399
Γ ₂₅₇	$\gamma f_0(500) \rightarrow \gamma\eta\eta$			DESIG=400
Γ ₂₅₈	$\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0$	$< 2.5 \times 10^{-6}$	CL=95%	DESIG=293
Γ ₂₅₉	$\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0$	$< 6.6 \times 10^{-6}$	CL=95%	DESIG=294
Γ ₂₆₀	$\gamma\eta\pi\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=96
Γ ₂₆₁	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		DESIG=142
Γ ₂₆₂	$\gamma\eta'(958)$	$(5.28 \pm 0.06) \times 10^{-3}$	S=1.3	DESIG=84
Γ ₂₆₃	$\gamma f_0(980) \rightarrow \gamma\pi\pi$			DESIG=393
Γ ₂₆₄	$\gamma f_0(980) \rightarrow \gamma K\bar{K}$			DESIG=394
Γ ₂₆₅	$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		DESIG=94
Γ ₂₆₆	$\gamma\rho\omega$	$< 5.4 \times 10^{-4}$	CL=90%	DESIG=226
Γ ₂₆₇	$\gamma\rho\phi$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=227
Γ ₂₆₈	$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		DESIG=97

Г ₂₆₉	$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=98
Г ₂₇₀	$\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi$	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	DESIG=89
Г ₂₇₁	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	DESIG=171
Г ₂₇₂	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=170
Г ₂₇₃	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	DESIG=124
Г ₂₇₄	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	$< 8.2 \times 10^{-5}$	CL=95%	DESIG=212
Г ₂₇₅	$\gamma\eta(1405) \rightarrow \gamma\gamma\gamma$	$< 2.63 \times 10^{-6}$	CL=90%	DESIG=348
Г ₂₇₆	$\gamma\eta(1475) \rightarrow \gamma\gamma\gamma$	$< 1.86 \times 10^{-6}$	CL=90%	DESIG=349
Г ₂₇₇	$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		DESIG=125
Г ₂₇₈	$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		DESIG=224
Г ₂₇₉	$\gamma\eta(1760) \rightarrow \gamma\gamma\gamma$	$< 4.80 \times 10^{-6}$	CL=90%	DESIG=347
Г ₂₈₀	$\gamma\eta(2225)$	$(3.14 \pm 0.50 \pm 0.19) \times 10^{-4}$		DESIG=126
Г ₂₈₁	$\gamma f_2(1270)$	$(1.63 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=86
Г ₂₈₂	$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.58 \pm 0.60 \pm 0.22) \times 10^{-5}$		DESIG=373
Г ₂₈₃	$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		DESIG=88
Г ₂₈₄	$\gamma f_0(1370) \rightarrow \gamma\pi\pi$			DESIG=395
Г ₂₈₅	$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(4.2 \pm 1.5) \times 10^{-4}$		DESIG=284
Г ₂₈₆	$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.1 \pm 0.4) \times 10^{-5}$		DESIG=368
Г ₂₈₇	$\gamma f_0(1370) \rightarrow \gamma\eta\eta$			DESIG=396
Г ₂₈₈	$\gamma f_0(1370) \rightarrow \gamma\eta\eta'$			DESIG=397
Г ₂₈₉	$\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi$	$(7.9 \pm 1.3) \times 10^{-4}$		DESIG=175
Г ₂₉₀	$\gamma f_0(1500) \rightarrow \gamma\pi\pi$	$(1.09 \pm 0.24) \times 10^{-4}$		DESIG=172
Г ₂₉₁	$\gamma f_0(1500) \rightarrow \gamma\eta\eta$	$(1.7 \pm 0.6 \pm 1.4) \times 10^{-5}$		DESIG=265
Г ₂₉₂	$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \pm 0.24 \pm 0.60) \times 10^{-5}$		DESIG=369
Г ₂₉₃	$\gamma f_0(1500) \rightarrow \gamma\eta\eta'$			DESIG=401
Г ₂₉₄	$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=141
Г ₂₉₅	$\gamma f_2'(1525)$	$(5.7 \pm 0.8 \pm 0.5) \times 10^{-4}$	S=1.5	DESIG=87
Г ₂₉₆	$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \pm 0.7 \pm 0.5) \times 10^{-5}$		DESIG=374
Г ₂₉₇	$\gamma f_2'(1525) \rightarrow \gamma\eta\eta$	$(3.4 \pm 1.4) \times 10^{-5}$		DESIG=268
Г ₂₉₈	$\gamma f_2(1565) \rightarrow \gamma\eta\eta'$			DESIG=432
Г ₂₉₉	$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=222
Г ₃₀₀	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=135
Г ₃₀₁	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(9.5 \pm 1.0 \pm 0.5) \times 10^{-4}$	S=1.5	DESIG=91
Г ₃₀₂	$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=221
Г ₃₀₃	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	$(2.4 \pm 1.2 \pm 0.7) \times 10^{-4}$		DESIG=266
Г ₃₀₄	$\gamma f_0(1710) \rightarrow \gamma\eta\eta'$			DESIG=402
Г ₃₀₅	$\gamma f_0(1710) \rightarrow \gamma\omega\phi$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=262
Г ₃₀₆	$\gamma f_0(1770) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \pm 0.20 \pm 0.33) \times 10^{-5}$		DESIG=370
Г ₃₀₇	$\gamma f_2(1810) \rightarrow \gamma\eta\eta$	$(5.4 \pm 3.5 \pm 2.4) \times 10^{-5}$		DESIG=269
Г ₃₀₈	$\gamma\eta_1(1855) \rightarrow \gamma\eta\eta'$	$(2.7 \pm 0.4 \pm 0.5) \times 10^{-6}$		DESIG=447
Г ₃₀₉	$\gamma f_0(1770) \rightarrow \gamma\eta\eta'$			DESIG=431
Г ₃₁₀	$\gamma f_2(1910) \rightarrow \gamma\omega\omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
Г ₃₁₁	$\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144
Г ₃₁₂	$\gamma f_2(2010) \rightarrow \gamma\eta\eta'$			DESIG=440
Г ₃₁₃	$\gamma f_0(2020) \rightarrow \gamma\pi\pi$			DESIG=403
Г ₃₁₄	$\gamma f_0(2020) \rightarrow \gamma K \bar{K}$			DESIG=404
Г ₃₁₅	$\gamma f_0(2020) \rightarrow \gamma\eta\eta$			DESIG=405
Г ₃₁₆	$\gamma f_0(2020) \rightarrow \gamma\eta'\eta'$	$(2.63 \pm 0.32 \pm 0.50) \times 10^{-4}$		DESIG=426
Г ₃₁₇	$\gamma f_0(2020) \rightarrow \gamma\eta\eta'$			DESIG=438

Γ ₃₁₈	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=100
Γ ₃₁₉	$\gamma f_4(2050) \rightarrow \gamma \eta \eta'$			DESIG=433
Γ ₃₂₀	$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \pm_{-0.30}^{+0.60}) \times 10^{-4}$		DESIG=267
Γ ₃₂₁	$\gamma f_0(2100) \rightarrow \gamma K \bar{K}$			DESIG=406
Γ ₃₂₂	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$		DESIG=286
Γ ₃₂₃	$\gamma f_0(2200)$	seen		DESIG=123;OUR EST;→ UNCHECKED ←
Γ ₃₂₄	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$		DESIG=285
Γ ₃₂₅	$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	$(2.72 \pm_{-0.50}^{+0.19}) \times 10^{-4}$		DESIG=371
Γ ₃₂₆	$\gamma f_0(2200) \rightarrow \gamma \pi \pi$			DESIG=407
Γ ₃₂₇	$\gamma f_0(2200) \rightarrow \gamma \eta \eta$			DESIG=408
Γ ₃₂₈	$\gamma f_J(2220)$	seen		DESIG=92;OUR EST;→ UNCHECKED ←
Γ ₃₂₉	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 3.9	$\times 10^{-5}$	CL=90% DESIG=136
Γ ₃₃₀	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 4.1	$\times 10^{-5}$	CL=90% DESIG=137
Γ ₃₃₁	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ ₃₃₂	$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	$(4.9 \pm 0.7) \times 10^{-5}$		DESIG=372
Γ ₃₃₃	$\gamma f_0(2330) \rightarrow \gamma \pi \pi$			DESIG=409
Γ ₃₃₄	$\gamma f_0(2330) \rightarrow \gamma \eta \eta$			DESIG=410
Γ ₃₃₅	$\gamma f_0(2330) \rightarrow \gamma \eta' \eta'$	$(6.1 \pm_{-1.8}^{+4.0}) \times 10^{-6}$		DESIG=427
Γ ₃₃₆	$\gamma f_0(2330) \rightarrow \gamma \eta \eta'$			DESIG=439
Γ ₃₃₇	$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \pm_{-2.2}^{+2.4}) \times 10^{-5}$		DESIG=270
Γ ₃₃₈	$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	$(5.5 \pm_{-1.5}^{+4.0}) \times 10^{-5}$		DESIG=375
Γ ₃₃₉	$\gamma f_2(2340) \rightarrow \gamma \eta' \eta'$	$(8.7 \pm_{-1.8}^{+0.9}) \times 10^{-6}$		DESIG=428
Γ ₃₄₀	$\gamma f_0(2470) \rightarrow \gamma \eta' \eta'$	$(8.2 \pm_{-2.8}^{+4.0}) \times 10^{-7}$		DESIG=429
Γ ₃₄₁	$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.7 \pm_{-0.8}^{+0.6}) \times 10^{-4}$	S=1.6	DESIG=213
Γ ₃₄₂	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \pm_{-0.9}^{+1.5}) \times 10^{-5}$		DESIG=254
Γ ₃₄₃	$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \pm_{-1.3}^{+2.0}) \times 10^{-5}$		DESIG=282
Γ ₃₄₄	$\gamma X(1835) \rightarrow \gamma \gamma \phi(1020)$			DESIG=346
Γ ₃₄₅	$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	< 3.56	$\times 10^{-6}$	CL=90% DESIG=350
Γ ₃₄₆	$\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm_{-0.8}^{+0.7}) \times 10^{-5}$		DESIG=264
Γ ₃₄₇	$\gamma X(2370) \rightarrow \gamma K^+ K^- \eta'$	$(1.8 \pm 0.7) \times 10^{-5}$		DESIG=388
Γ ₃₄₈	$\gamma X(2370) \rightarrow \gamma K_S^0 K_S^0 \eta'$	$(1.2 \pm 0.5) \times 10^{-5}$		DESIG=389
Γ ₃₄₉	$\gamma X(2370) \rightarrow \gamma \eta \eta \eta'$	< 9.2	$\times 10^{-6}$	CL=90% DESIG=390
Γ ₃₅₀	$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=90
Γ ₃₅₁	$\gamma p \bar{p} \pi^+ \pi^-$	< 7.9	$\times 10^{-4}$	CL=90% DESIG=93
Γ ₃₅₂	$\gamma \Lambda \bar{\Lambda}$	< 1.3	$\times 10^{-4}$	CL=90% DESIG=200
Γ ₃₅₃	$\gamma A^0 \rightarrow \gamma \text{invisible}$	[e] < 1.7	$\times 10^{-6}$	CL=90% DESIG=251
Γ ₃₅₄	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	[f] < 7.8	$\times 10^{-7}$	CL=90% DESIG=259

Dalitz decays

Γ ₃₅₅	$\pi^0 e^+ e^-$	$(7.6 \pm 1.4) \times 10^{-7}$		NODE=M070;CLUMP=G DESIG=271
Γ ₃₅₆	$\eta e^+ e^-$	$(1.42 \pm 0.08) \times 10^{-5}$		DESIG=272
Γ ₃₅₇	$\eta'(958) e^+ e^-$	$(6.59 \pm 0.18) \times 10^{-5}$		DESIG=273
Γ ₃₅₈	$X(1835) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(3.58 \pm 0.25) \times 10^{-6}$		DESIG=423
Γ ₃₅₉	$X(2120) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(8.2 \pm 1.3) \times 10^{-7}$		DESIG=425
Γ ₃₆₀	$X(2370) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta'$	$(1.08 \pm 0.17) \times 10^{-6}$		DESIG=424
Γ ₃₆₁	$\eta U \rightarrow \eta e^+ e^-$	[g] < 9.11	$\times 10^{-7}$	CL=90% DESIG=352
Γ ₃₆₂	$\eta'(958) U \rightarrow \eta'(958) e^+ e^-$	[g] < 2.0	$\times 10^{-7}$	CL=90% DESIG=366
Γ ₃₆₃	$\phi e^+ e^-$	< 1.2	$\times 10^{-7}$	CL=90% DESIG=384

Weak decays

Γ_{364}	$D^- e^+ \nu_e + \text{c.c.}$	< 7.1	$\times 10^{-8}$	CL=90%
Γ_{365}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	< 8.5	$\times 10^{-8}$	CL=90%
Γ_{366}	$D_s^- e^+ \nu_e + \text{c.c.}$	< 1.3	$\times 10^{-6}$	CL=90%
Γ_{367}	$D_s^{*-} e^+ \nu_e + \text{c.c.}$	< 1.8	$\times 10^{-6}$	CL=90%
Γ_{368}	$D^- \pi^+ + \text{c.c.}$	< 7.5	$\times 10^{-5}$	CL=90%
Γ_{369}	$\bar{D}^0 \bar{K}^0 + \text{c.c.}$	< 1.7	$\times 10^{-4}$	CL=90%
Γ_{370}	$\bar{D}^0 \bar{K}^{*0} + \text{c.c.}$	< 2.5	$\times 10^{-6}$	CL=90%
Γ_{371}	$D_s^- \pi^+ + \text{c.c.}$	< 1.3	$\times 10^{-4}$	CL=90%
Γ_{372}	$D_s^- \rho^+ + \text{c.c.}$	< 1.3	$\times 10^{-5}$	CL=90%

NODE=M070;CLUMP=E

DESIG=218

DESIG=219

DESIG=220

DESIG=290

DESIG=241

DESIG=242

DESIG=275

DESIG=243

DESIG=274

**Charge conjugation (C), Parity (P),
Lepton Family number (LF) violating modes**

NODE=M070;CLUMP=D

Γ_{373}	$\gamma\gamma$	C	< 2.7	$\times 10^{-7}$	CL=90%
Γ_{374}	$\gamma\phi$	C	< 1.4	$\times 10^{-6}$	CL=90%
Γ_{375}	$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90%
Γ_{376}	$e^\pm \tau^\mp$	LF	< 7.5	$\times 10^{-8}$	CL=90%
Γ_{377}	$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90%
Γ_{378}	$\Lambda_c^+ e^- + \text{c.c.}$		< 6.9	$\times 10^{-8}$	CL=90%

DESIG=80

DESIG=277

DESIG=177

DESIG=178

DESIG=179

DESIG=379

Other decays

Γ_{379}	invisible	< 7	$\times 10^{-4}$	CL=90%

NODE=M070;CLUMP=F

DESIG=240

[a] For $E_\gamma > 100$ MeV.

LINKAGE=Egm

[b] The value is for the sum of the charge states or particle/antiparticle states indicated.

LINKAGE=SG

[c] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54 \text{ GeV}/c^2$ mass and a width of less than $25 \text{ MeV}/c^2$.

LINKAGE=THt

[d] Includes $p\bar{p}\pi^+\pi^-\gamma$ and excludes $p\bar{p}\eta$, $p\bar{p}\omega$, $p\bar{p}\eta'$.

LINKAGE=MF

[e] For a narrow state A with mass less than 960 MeV.

LINKAGE=NSA

[f] For a narrow scalar or pseudoscalar A^0 with mass $0.21\text{--}3.0$ GeV.

LINKAGE=NA0

[g] For a dark photon U with mass between 100 and 2100 MeV.

LINKAGE=DPH

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and $B^\pm$ with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

 $J/\psi(1S)$ PARTIAL WIDTHS

NODE=M070220

 $\Gamma(\text{hadrons})$ **Γ_1**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
$81.37 \pm 1.36 \pm 1.30$	¹ ANASHIN	20 KEDR	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
74.1 ± 8.1	BAI	95B BES	$e^+ e^-$
59 ± 24	BALDINI-...	75 FRAG	$e^+ e^-$
59 ± 14	BOYARSKI	75 MRK1	$e^+ e^-$
50 ± 25	ESPOSITO	75B FRAM	$e^+ e^-$

NODE=M070W3

NODE=M070W3

¹ Based on the same dataset as ANASHIN 18A and correlated to the values reported there

NODE=M070W3;LINKAGE=A

$\Gamma(e^+e^-)$ Γ_5

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.53 ± 0.10 OUR AVERAGE				
5.550 $\pm 0.056 \pm 0.089$	1,2	ANASHIN	18A	KEDR e^+e^-
5.36 $^{+0.29}_{-0.28}$	3	HSUEH	92	RVUE See γ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.58 $\pm 0.05 \pm 0.08$	4	ABLIKIM	16Q	BES3 $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.71 ± 0.16	13k	5 ADAMS	06A	CLEO $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.57 ± 0.19	7.8k	5 AUBERT	04	BABR $e^+e^- \rightarrow \mu^+\mu^-\gamma$
5.14 ± 0.39		BAI	95B	BES e^+e^-
4.72 ± 0.35		ALEXANDER	89	RVUE See γ mini-review
4.4 ± 0.6	3	BRANDELIK	79C	DASP e^+e^-
4.6 ± 0.8	6	BALDINI-...	75	FRAG e^+e^-
4.8 ± 0.6		BOYARSKI	75	MRK1 e^+e^-
4.6 ± 1.0		ESPOSITO	75B	FRAM e^+e^-

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow$ hadrons near the $J/\psi(1S)$ peak.

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

³ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

⁴ Using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.973 \pm 0.007 \pm 0.037)\%$ from ABLIKIM 13R.

⁵ Calculated by us from the reported values of $\Gamma(e^+e^-) \times B(\mu^+\mu^-)$ using $B(\mu^+\mu^-) = (5.93 \pm 0.06)\%$.

⁶ Assuming equal partial widths for e^+e^- and $\mu^+\mu^-$.

NODE=M070W1
NODE=M070W1

OCCUR=4

NODE=M070W1;LINKAGE=D

NODE=M070W1;LINKAGE=E
NODE=M070W1;LINKAGE=F

NODE=M070W1;LINKAGE=A
NODE=M070W1;LINKAGE=AA

NODE=M070W1;LINKAGE=B

 $\Gamma(\mu^+\mu^-)$ Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.13 ± 0.52	BAI	95B	BES e^+e^-
4.8 ± 0.6	BOYARSKI	75	MRK1 e^+e^-
5 ± 1	ESPOSITO	75B	FRAM e^+e^-

NODE=M070W2
NODE=M070W2

 $\Gamma(\gamma\gamma)$ Γ_{373}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.4	90	BRANDELIK	79C	DASP e^+e^-

NODE=M070W70
NODE=M070W70

 $J/\psi(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel(l) in the e^+e^- annihilation.

NODE=M070225

NODE=M070225

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_5 / \Gamma$

<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
4.884±0.048±0.078	^{1,2} ANASHIN	18A	KEDR e ⁺ e ⁻
4 ±0.8	³ BALDINI-...	75	FRAG e ⁺ e ⁻
3.9 ±0.8	³ ESPOSITO	75B	FRAM e ⁺ e ⁻

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow$ hadrons near the $J/\psi(1S)$ peak.

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

³ Data redundant with branching ratios or partial widths above.

NODE=M070G3;LINKAGE=A

NODE=M070G3;LINKAGE=B
NODE=M070G3;LINKAGE=S

 $\Gamma(e^+e^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_5 \Gamma_5 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
333.1± 6.6±4.0	1,2 ANASHIN	18A KEDR	e^+e^-
332.3± 6.4±4.8	ANASHIN	10 KEDR	$3.097 e^+e^- \rightarrow e^+e^-$
350 ± 20	BRANDELIK	79C DASP	e^+e^-
320 ± 70	3 BALDINI-...	75 FRAG	e^+e^-
340 ± 90	3 ESPOSITO	75B FRAM	e^+e^-
360 ±100	3 FORD	75 SPEC	e^+e^-

¹ From the cross sections of $e^+e^- \rightarrow e^+e^-$ and $e^+e^- \rightarrow$ hadrons near the $J/\psi(1S)$ peak.

² Based on the same dataset as ANASHIN 20 and correlated to the values reported there.

³ Data redundant with branching ratios or partial widths above.

NODE=M070G1
NODE=M070G1

OCCUR=2

NODE=M070G1;LINKAGE=A

NODE=M070G1;LINKAGE=B
NODE=M070G1;LINKAGE=S

$$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_7\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
333 ± 4 OUR AVERAGE				
333.4 ± 2.5 ± 4.4		ABLIKIM	16Q BES3	3.773 $e^+e^- \rightarrow \mu^+\mu^-\gamma$
331.8 ± 5.2 ± 6.3		ANASHIN	10 KEDR	3.097 $e^+e^- \rightarrow \mu^+\mu^-$
338.4 ± 5.8 ± 7.1	13k	ADAMS	06A CLEO	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
330.1 ± 7.7 ± 7.3	7.8k	AUBERT	04 BABR	$e^+e^- \rightarrow \mu^+\mu^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
510 ± 90		DASP	75 DASP	e^+e^-
380 ± 50		¹ ESPOSITO	75B FRAM	e^+e^-

¹ Data redundant with branching ratios or partial widths above.

NODE=M070G2
NODE=M070G2

NODE=M070G2;LINKAGE=S

$$\Gamma(\eta\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{13}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.4 OUR AVERAGE				
2.34 ± 0.43 ± 0.16	49	LEES	18 BABR	$e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$
2.22 ± 0.96 ± 0.02	9	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \eta\pi^+\pi^-\gamma$

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow \pi^+\pi^-\pi^0)] = 0.51 \pm 0.22 \pm 0.03$ eV which we divide by our best value $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.02 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G25
NODE=M070G25

NODE=M070G25;LINKAGE=AU

$$\Gamma(\eta\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{15}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
64.8 ± 11.1 ± 0.4	200	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-\pi^0)$

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] = 21.1 \pm 1.7 \pm 3.2$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q20
NODE=M070Q20

NODE=M070Q20;LINKAGE=A

$$\Gamma(\eta\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{16}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
26.9 ± 5.7 ± 0.1	101	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-\pi^0\gamma\gamma)$

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \eta\pi^+\pi^-\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.6 \pm 1.6 \pm 1.6$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q19
NODE=M070Q19

NODE=M070Q19;LINKAGE=A

$$\Gamma(\eta K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{19}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
4.76 ± 1.64 ± 0.03	¹ LEES	23 BABR	$e^+e^- \rightarrow \gamma_{ISR}$ hadrons

¹ LEES 23 reports $[\Gamma(J/\psi(1S) \rightarrow \eta K^+K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] = 1.55 \pm 0.51 \pm 0.16$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q54
NODE=M070Q54

NODE=M070Q54;LINKAGE=A

$$\Gamma(\eta K^\pm K_S^0 \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{20}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 1.4 ± 0.4	44	LEES	17D BABR	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G38
NODE=M070G38

$$\Gamma(K_S^0 K^\pm \pi^\mp \rho(770)^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{196}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
17.3 ± 2.1 ± 1.7	LEES	23 BABR	$e^+e^- \rightarrow \gamma_{ISR}$ hadrons

NODE=M070Q55
NODE=M070Q55

$$\Gamma(\rho^\pm \pi^\mp \pi^+ \pi^- 2\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{23}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
160 ± 40 OUR AVERAGE		[155 ± 40 eV OUR 2023 AVERAGE]		
155 ± 26 ± 36	14k	LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q13
NODE=M070Q13

NEW

$$\Gamma(\rho^+ \rho^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{24}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
32 ± 13 ± 15	14k	LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M070Q14
NODE=M070Q14

$$\Gamma(\rho^\mp K^\pm K_S^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.4±1.0±1.9	130	LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G31
NODE=M070G31

$$\Gamma(\omega \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
53.6±5.0±0.4	788	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \omega \pi^+ \pi^- \gamma$

NODE=M070G24
NODE=M070G24

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega \pi^+ \pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 47.8 \pm 3.1 \pm 3.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(\omega \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
27.8±3.5±0.2	398	¹ LEES	18E BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$

NODE=M070P54
NODE=M070P54

¹ LEES 18E reports $[\Gamma(J/\psi(1S) \rightarrow \omega \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 24.8 \pm 1.8 \pm 2.5$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P54;LINKAGE=A

$$\Gamma(\omega 3\pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{43}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.5±3.1±0.1	89	¹ LEES	21C BABR	$e^+ e^- \rightarrow \gamma_{ISR}(\pi^+ \pi^- 4\pi^0)$

NODE=M070Q18
NODE=M070Q18

¹ LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \omega 3\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 9.4 \pm 2.3 \pm 1.5$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q18;LINKAGE=A

$$\Gamma(\omega \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_5/\Gamma$$

VALUE (10^{-2} keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.3±0.2	170	AUBERT	06D BABR	$10.6 e^+ e^- \rightarrow \omega \pi^+ \pi^- \pi^0 \gamma$

NODE=M070G8
NODE=M070G8

$$\Gamma(\omega \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
16.9±7.6±0.2	¹ LEES	21C BABR	$e^+ e^- \rightarrow \gamma_{ISR}(\pi^+ \pi^- 4\pi^0)$

NODE=M070Q21
NODE=M070Q21

¹ Different final state as in AUBERT 06. LEES 21C reports $[\Gamma(J/\psi(1S) \rightarrow \omega \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 4.9 \pm 2.1 \pm 0.7$ eV which we divide by our best values $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.21) \times 10^{-2}$, $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070Q21;LINKAGE=A

$$\Gamma(\omega \pi^0 \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{47}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.90±0.96±0.01	27	¹ LEES	18E BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta \gamma$

NODE=M070P58
NODE=M070P58

¹ LEES 18E reports $[\Gamma(J/\psi(1S) \rightarrow \omega \pi^0 \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 1.7 \pm 0.8 \pm 0.3$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P58;LINKAGE=A

$$\Gamma(\omega \pi^+ \pi^- 2\pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{49}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
185±30±1	14k	¹ LEES	21 BABR	$10.6 e^+ e^- \rightarrow 2(\pi^+ \pi^-) 3\pi^0 \gamma$

NODE=M070Q11
NODE=M070Q11

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow \omega \pi^+ \pi^- 2\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 165 \pm 9 \pm 25$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q11;LINKAGE=A

$$\Gamma(\omega K \bar{K}) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{60}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70±1.98±0.03	24	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \omega K^+ K^- \gamma$

NODE=M070G29
NODE=M070G29

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \omega K \bar{K}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = 3.3 \pm 1.3 \pm 1.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G29;LINKAGE=AU

$$\Gamma(K^+ K^*(892)^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{69} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.0±1.7±1.3	AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^+ K^*(892)^- \gamma$

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{70} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.96±0.85±0.70	155	AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{71} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
16.76±1.70±1.00	89	AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{72} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±2.5±1.5	AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K^0 \bar{K}^*(892)^0 \gamma$

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{73} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
17.70±1.70±1.00	94	AUBERT	08S BABR	10.6 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G22
NODE=M070G22

$$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{74} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
42.6±4.8±7.2	99	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G39
NODE=M070G39

¹ Dividing by 1/6 to account for $B(K^*(892)^0 \rightarrow K_S^0 \pi^0) = 1/6$.

NODE=M070G39;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{75} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
22.8±2.8±6.8	80	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G32
NODE=M070G32

¹ Dividing by 1/4 to account for $B(K^*(892)^\pm \rightarrow K_S^0 \pi^\pm) = 1/4$.

NODE=M070G32;LINKAGE=A

$$\Gamma(K^*(892)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{76} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.0±2.8 OUR AVERAGE				
9.2±1.2±3.2	64	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$
14.8±4.8±1.2	53	² LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY4
NODE=M070GY4

¹ Dividing by 1/2 to take into account $B(K^*(892)^\pm \rightarrow K^\pm \pi^\mp) = 1/2$.

² Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY4;LINKAGE=B
NODE=M070GY4;LINKAGE=A

$$\Gamma(K^*(892)^+ K_S^0 \pi^- + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{77} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.7±1.2±0.3	53	LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY5
NODE=M070GY5

$$\Gamma(K^*(892)^0 K_S^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{80} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.60±0.75±2.25	34	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G33
NODE=M070G33

¹ Dividing by 2/3 to account for $B(K^*(892)^0 \rightarrow K^+ \pi^-) = 2/3$.

NODE=M070G33;LINKAGE=A

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{82} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.28±0.34±0.07	47±12	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M070G01
NODE=M070G01

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.28±0.40±0.11 25±8 ^{1,2} AUBERT 07AK BABR 10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Dividing by (2/3)² to take twice into account that $B(K^*0 \rightarrow K^+ \pi^-) = 2/3 B(K^*0 \rightarrow K \pi)$.

NODE=M070G01;LINKAGE=AE

² Superseded by LEES 12F.

NODE=M070G01;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^*(892)^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{83} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.80±0.48±0.32	1±5	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY8
NODE=M070GY8

¹ Dividing by (1/4)² to take twice into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY8;LINKAGE=A

$$\Gamma(K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{94} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.1 ± 9.8 ± 0.5	35	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by 1/4 to take into account $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K^*(1430) \rightarrow K \pi)$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_2^*(1430)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 10.0 \pm 4.8 \pm 0.8$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY6
NODE=M070GY6

NODE=M070GY6;LINKAGE=A

NODE=M070GY6;LINKAGE=B

$$\Gamma(K_2^*(1430)^0 K^- \pi^+ + \text{c.c.} \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{93} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.65 ± 0.80 ± 0.44	1094	ANASHIN	22 KEDR	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M070Q43
NODE=M070Q43

$$\Gamma(\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{95} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.8 ± 1.4 ± 0.6	710	^{1,2,3} LEES	12F BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

33 ± 4 ± 1	317	^{2,4} AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 12.89 \pm 0.54 \pm 0.41$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3 B(K^{*0} \rightarrow K \pi)$.

³ The $K_2^*(1430)$ cannot be distinguished from the $K_0^*(1430)$.

⁴ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 16.4 \pm 1.1 \pm 1.4$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G02
NODE=M070G02

NODE=M070G02;LINKAGE=A

NODE=M070G02;LINKAGE=AE

NODE=M070G02;LINKAGE=B

NODE=M070G02;LINKAGE=UB

$$\Gamma(K_2^*(1430)^- K^*(892)^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{96} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.6 ± 16.1 ± 0.4	8 ± 8	^{1,2} LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by $(1/4)^2$ to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$ and $B(K^*(1430) \rightarrow K_S^0 \pi) = 1/4 B(K^*(1430) \rightarrow K \pi)$.

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow K_2^*(1430)^- K^*(892)^+ + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 9.28 \pm 8.0 \pm 0.32$ eV which we divide by our best value $B(K_2^*(1430) \rightarrow K \pi) = (49.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GY9
NODE=M070GY9

NODE=M070GY9;LINKAGE=A

NODE=M070GY9;LINKAGE=B

$$\Gamma(K_2^*(1430)^- K^*(892)^+ + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{97} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.32 ± 2.00 ± 0.08	8 ± 8	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by 1/4 to take into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GZ0
NODE=M070GZ0

NODE=M070GZ0;LINKAGE=A

$$\Gamma(\bar{K}_2^*(1770)^0 K^*(892)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{99} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.4 ± 0.3	110 ± 14	¹ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Dividing by 2/3 to take into account that $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3$.

NODE=M070G03
NODE=M070G03

NODE=M070G03;LINKAGE=AE

$$\Gamma(\phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{106} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.48 ± 0.35 OUR AVERAGE				

4.46 ± 0.49 ± 0.05	181	¹ LEES	12F BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

4.51 ± 0.48 ± 0.05	254 ± 23	² SHEN	09 BELL	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.3 ± 0.7 ± 0.1	103	³ AUBERT, BE 06D	BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

NODE=M070G14
NODE=M070G14

- ¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 2.19 \pm 0.23 \pm 0.07$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² SHEN 09 reports $4.50 \pm 0.41 \pm 0.26$ eV from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)]$ assuming $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.6) \times 10^{-2}$, which we rescale to our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 2.61 \pm 0.30 \pm 0.18$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=B

NODE=M070G14;LINKAGE=SH

NODE=M070G14;LINKAGE=AU

$\Gamma(\phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{107}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.77±0.57±0.03	45	¹ LEES 12F	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.13±0.88±0.03	23	² AUBERT, BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$
¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.36 \pm 0.27 \pm 0.07$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi\pi^0\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 1.54 \pm 0.40 \pm 0.16$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G15
NODE=M070G15

NODE=M070G15;LINKAGE=A

NODE=M070G15;LINKAGE=AU

$\Gamma(\phi 2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{108}\Gamma_5/\Gamma$

VALUE (10^{-2} keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.96±0.19±0.01	35	¹ AUBERT 06D	BABR	10.6 $e^+e^- \rightarrow \phi 2(\pi^+\pi^-)\gamma$
¹ AUBERT 06D reports $[\Gamma(J/\psi(1S) \rightarrow \phi 2(\pi^+\pi^-)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = (0.47 \pm 0.09 \pm 0.03) \times 10^{-2}$ keV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G10
NODE=M070G10

NODE=M070G10;LINKAGE=AU

$\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{109}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.6±1.4 OUR AVERAGE				
[6.1 ± 2.7 eV OUR 2023 AVERAGE]				
4.1±1.6±0.4		¹ LEES 23	BABR	$e^+e^- \rightarrow \gamma_{ISR} \text{ hadrons}$
6.1±2.7±0.4	6	² AUBERT 07AU	BABR	10.6 $e^+e^- \rightarrow \phi\eta\gamma$
¹ LEES 23 quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi\eta) \cdot B(\phi \rightarrow K^+K^-) \cdot B(\eta \rightarrow 3\pi^0) = 0.64 \pm 0.26 \pm 0.06$ eV.				
² AUBERT 07AU quotes $\Gamma_{ee}^{J/\psi} \cdot B(J/\psi \rightarrow \phi\eta) \cdot B(\phi \rightarrow K^+K^-) \cdot B(\eta \rightarrow 3\pi) = 0.84 \pm 0.37 \pm 0.05$ eV.				

NODE=M070G28
NODE=M070G28
NEW

OCCUR=2

NODE=M070G28;LINKAGE=A

NODE=M070G28;LINKAGE=AU

$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{113}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.19 OUR AVERAGE				
1.40±0.25±0.01	57 ± 9	¹ LEES 12F	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
1.48±0.27±0.09	60 ± 11	² SHEN 09	BELL	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.02±0.24±0.01	20 ± 5	³ AUBERT 07AK	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
¹ LEES 12F reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.69 \pm 0.11 \pm 0.05$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Multiplied by 2/3 to take into account the $\phi\pi^+\pi^-$ mode only. Using $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.6)\%$.				
³ Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.50 \pm 0.11 \pm 0.04$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M070G05
NODE=M070G05

NODE=M070G05;LINKAGE=A

NODE=M070G05;LINKAGE=SH

NODE=M070G05;LINKAGE=UB

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{114} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.98±0.26±0.01	16 ± 4	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.96±0.40±0.01	7.0 ± 2.8	² AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

¹ LEES 12F reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.48 \pm 0.12 \pm 0.05$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 0.47 \pm 0.19 \pm 0.05$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06
NODE=M070G06

NODE=M070G06;LINKAGE=A

NODE=M070G06;LINKAGE=UB

$$\Gamma(\phi f_2(1270)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{119} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.79±0.32^{+0.02}_{-0.06}	61	^{1,2,3} LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.08±0.73 ^{+0.05} _{-0.14}	44	^{2,4} AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ

¹ LEES 12F reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 1.51 \pm 0.25 \pm 0.10$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

³ Using π⁺π⁻ invariant mass between 1.1 and 1.5 GeV. May include other sources such as f₀(1370).

⁴ Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(J/\psi(1S) \rightarrow \phi f_2(1270)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = 3.44 \pm 0.55 \pm 0.28$ eV which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G07
NODE=M070G07

NODE=M070G07;LINKAGE=A

NODE=M070G07;LINKAGE=AE

NODE=M070G07;LINKAGE=B

NODE=M070G07;LINKAGE=UB

$$\Gamma(\phi f'_2(1525)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{124} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

8.1±3.2 OUR AVERAGE	[8.2 ± 3.2 eV OUR 2023 AVERAGE]			

8.1±3.2±0.2	11	^{1,2} LEES	14H BABR	e ⁺ e ⁻ → K _S ⁰ K _S ⁰ K ⁺ K ⁻ γ

¹ Dividing by 1/4 to take into account $B(f'_2(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f'_2(1525) \rightarrow K \bar{K})$ and using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

² LEES 14H reports [$\Gamma(J/\psi(1S) \rightarrow \phi f'_2(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})] = 7.2 \pm 2.8 \pm 0.3$ eV which we divide by our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ2
NODE=M070GZ2

NEW

NODE=M070GZ2;LINKAGE=A

NODE=M070GZ2;LINKAGE=B

$$\Gamma(\phi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{130} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.60±0.62±0.05	163	¹ LEES	12F BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ K ⁺ K ⁻ γ

¹ LEES 12F reports [$\Gamma(J/\psi(1S) \rightarrow \phi K^+ K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 2.26 \pm 0.26 \pm 0.16$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G09
NODE=M070G09

NODE=M070G09;LINKAGE=A

$$\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{131} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

3.26±0.84±0.03	29	¹ LEES	14H BABR	e ⁺ e ⁻ → K _S ⁰ K _S ⁰ K ⁺ K ⁻ γ

¹ LEES 14H reports [$\Gamma(J/\psi(1S) \rightarrow \phi K_S^0 K_S^0) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] = 1.6 \pm 0.4 \pm 0.1$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ1
NODE=M070GZ1

NODE=M070GZ1;LINKAGE=A

$$\Gamma(f'_2(1525)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{136}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.8±1.9±0.1	16	1,2 LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+K^- \gamma$

NODE=M070GZ4
NODE=M070GZ4

¹ Dividing by 1/4 to take into account $B(f'_2(1525) \rightarrow K_S^0 K_S^0) = 1/4 B(f'_2(1525) \rightarrow K\bar{K})$.

NODE=M070GZ4;LINKAGE=A

² LEES 14H reports $[\Gamma(J/\psi(1S) \rightarrow f'_2(1525)K^+K^-) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] = 5.12 \pm 1.68 \pm 0.20$ eV which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ4;LINKAGE=B

$$\Gamma(2(\pi^+\pi^-)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{157}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
303±5±18	4990	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0 \gamma$

NODE=M070G23
NODE=M070G23

$$\Gamma(\pi^+\pi^-3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{159}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
100 ±50 OUR AVERAGE		Error includes scale factor of 4.3. [104 ± 50 eV OUR 2023 AVERAGE Scale factor = 4.3]		

NODE=M070P53
NODE=M070P53

NEW

55 ±16 ± 1	14k	¹ LEES	21 BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0 \gamma$
150.0 ± 4.0 ±15.0	2.3k	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0 \gamma$

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-3\pi^0) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] = 19.2 \pm 4.5 \pm 3.2$ eV which we divide by our best value $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}} = 0.3469 \pm 0.0034$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P53;LINKAGE=A

$$\Gamma(\pi^+\pi^-4\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{162}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
35.8±4.4±5.4	340	LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M070Q17
NODE=M070Q17

$$\Gamma(\rho^\pm\pi^\mp\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{160}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
78.0±9.0±8.0	1.2k	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0 \gamma$

NODE=M070P55
NODE=M070P55

$$\Gamma(\rho^+\rho^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{161}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
33.0±5.0±3.3	529	LEES	18E BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-3\pi^0 \gamma$

NODE=M070P56
NODE=M070P56

$$\Gamma(\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{163}\Gamma_5/\Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.1248±0.0019±0.0026	LEES	21B BABR	$10.5 e^+e^- \rightarrow \pi^+\pi^-\pi^0 \gamma$

NODE=M070G5
NODE=M070G5

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.122 ± 0.005 ± 0.008	AUBERT,B	04N BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0 \gamma$

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{164}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.9±0.5±1.0	761	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M070G7
NODE=M070G7

$$\Gamma(\pi^+\pi^-\pi^0K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{165}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
107.0±4.3±6.4	768	AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0 \gamma$

NODE=M070G27
NODE=M070G27

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{167}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±0.9±0.4		LEES	12E BABR	$10.6 e^+e^- \rightarrow 2\pi^+2\pi^- \gamma$

NODE=M070G11
NODE=M070G11

• • • We do not use the following data for averages, fits, limits, etc. • • •

19.5±1.4±1.3	270	¹ AUBERT	05D BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\gamma$

¹ Superseded by LEES 12E.

NODE=M070G11;LINKAGE=AU

$$\Gamma(3(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{168}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.37±0.16±0.14	496	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow 3(\pi^+\pi^-)\gamma$

NODE=M070G6
NODE=M070G6

$$\Gamma(2(\pi^+\pi^-)3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{169}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
350±50 OUR AVERAGE		[345 ± 50 eV OUR 2023 AVERAGE]		
345±10±50	14k	LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ

NODE=M070Q12
NODE=M070Q12
NEW

$$\Gamma(2(\pi^+\pi^-)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{171}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
13.1±2.4±0.1	85	¹ AUBERT	07AU	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)ηγ

NODE=M070G26
NODE=M070G26

¹ AUBERT 07AU reports [$\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-)\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [B(η → 2γ)] = 5.16 ± 0.85 ± 0.39 eV which we divide by our best value B(η → 2γ) = (39.36 ± 0.18) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G26;LINKAGE=AU

$$\Gamma(2(\pi^+\pi^-\pi^0)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{173}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
9.1±2.6±1.4	14k	LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ

NODE=M070Q15
NODE=M070Q15

$$\Gamma(\pi^+\pi^-\pi^0\pi^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{174}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
13.1± 2.7 OUR AVERAGE				

26.1±17.9±0.3	14k	¹ LEES	21	BABR 10.6 e ⁺ e ⁻ → 2(π ⁺ π ⁻)3π ⁰ γ
12.8± 1.8±2.0	203	LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ π ⁰ ηγ

¹ LEES 21 reports [$\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}$] × [B(η → π⁺π⁻π⁰)] = 6 ± 4 ± 1 eV which we divide by our best value B(η → π⁺π⁻π⁰) = (23.02 ± 0.25) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P57
NODE=M070P57

NODE=M070P57;LINKAGE=A

$$\Gamma(\rho^\pm\pi^\mp\pi^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{175}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
10.5±4.1±1.6	168	LEES	18E	BABR 10.6 e ⁺ e ⁻ → π ⁺ π ⁻ π ⁰ π ⁰ ηγ

NODE=M070P59
NODE=M070P59

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{176}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.78±0.11±0.05	462	¹ LEES	15J	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ
1.94±0.11±0.05	462	² LEES	15J	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ
1.42±0.23±0.08	51	³ LEES	13Q	BABR e ⁺ e ⁻ → K ⁺ K ⁻ γ

NODE=M070G08
NODE=M070G08

OCCUR=2

¹ sinφ > 0.

² sinφ < 0.

³ Interference with non-resonant K⁺K⁻ production not taken into account.

NODE=M070G08;LINKAGE=A
NODE=M070G08;LINKAGE=B
NODE=M070G08;LINKAGE=BA

$$\Gamma(K_S^0 K_L^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{182}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
11.4±1.3±0.6	182	LEES	17A	BABR e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ γ

NODE=M070G41
NODE=M070G41

$$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{183}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
6.7±0.9±0.4	106	LEES	17A	BABR e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ γ

NODE=M070G42
NODE=M070G42

$$\Gamma(K_2^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{184}\Gamma_5/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.4±0.7±0.1	37	LEES	17A	BABR e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ γ

NODE=M070G43
NODE=M070G43

$$\Gamma(K_S^0 K^*(892)^0 \pi^+ \pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{201}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
9.45±3.15±0.90	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M070Q56
NODE=M070Q56

$$\Gamma(K_S^0 K^*(892)^0 \pi^0 \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{202}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
5.59±0.79±0.55	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M070Q61
NODE=M070Q61

$$\Gamma(K^\mp K^*(892)^\pm \pi^+ \pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{203}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
18.6±6.3±1.8	LEES	23	BABR e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M070Q57
NODE=M070Q57

$$\Gamma(K^\mp K^*(892)^\pm \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{205} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
8.67±1.56±0.84	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q60
NODE=M070Q60

$$\Gamma(K^*(892)^\pm K^*(892)^0 \pi^\mp) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{204} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
26.6±4.5±2.7	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q58
NODE=M070Q58

$$\Gamma(K^*(892)^+ K^*(892)^- \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{206} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
62.1±10.8±6.30	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q59
NODE=M070Q59

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{185} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
37.94±0.81±1.10	3.1k	LEES	12F	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M070G12
NODE=M070G12

• • • We do not use the following data for averages, fits, limits, etc. • • •

36.3 ±1.3 ±2.1	1.5k	¹ AUBERT	07AK	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
33.6 ±2.7 ±2.7	233	² AUBERT	05D	BABR $10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

NODE=M070G12;LINKAGE=B
NODE=M070G12;LINKAGE=A

$$\Gamma(K^+ K^- \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{186} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.75±0.81±0.90	388	LEES	12F	BABR $10.6 e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

NODE=M070G04
NODE=M070G04

• • • We do not use the following data for averages, fits, limits, etc. • • •

13.6 ±1.1 ±1.3	203	¹ AUBERT	07AK	BABR $10.6 e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

¹ Superseded by LEES 12F.

NODE=M070G04;LINKAGE=A

$$\Gamma(K^+ K^- \pi^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{187} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
8.9±1.3±0.9	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q51
NODE=M070Q51

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{188} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
29.3±2.6±2.9	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q52
NODE=M070Q52

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{189} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
34.6±1.4±1.8	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q53
NODE=M070Q53

$$\Gamma(K_S^0 K_L^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{191} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
20.8±2.3±2.1	248	LEES	14H	BABR $e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_L^0 \gamma$

NODE=M070GY1
NODE=M070GY1

$$\Gamma(K_S^0 K_L^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{192} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.3±2.3±0.5	47	LEES	17A	BABR $e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \pi^0 \gamma$

NODE=M070G40
NODE=M070G40

$$\Gamma(K_S^0 K_L^0 \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{193} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±1.8±0.4	45	LEES	17A	BABR $e^+ e^- \rightarrow K_S^0 K_L^0 \eta \gamma$

NODE=M070G35
NODE=M070G35

$$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{194} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±0.9±0.5	133	LEES	14H	BABR $e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

NODE=M070GY2
NODE=M070GY2

$$\Gamma(K^\mp K_S^0 \pi^\pm \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{195} \Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
31.7±1.9±1.8	393	LEES	17D	BABR $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G34
NODE=M070G34

$$\Gamma(K_S^0 K^\pm \rho(770)^\pm \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{190} \Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
16.0±4.1±1.6	LEES	23	BABR $e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

NODE=M070Q62
NODE=M070Q62

$$\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{197}\Gamma_5/\Gamma$$

VALUE (10 ⁻² keV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.75±0.23±0.17	205	AUBERT	06D BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ 2(π ⁺ π ⁻)γ

NODE=M070G9
NODE=M070G9

$$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{198}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9±3.9±0.1	73	¹ AUBERT 07AU	BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ ηγ

NODE=M070G30
NODE=M070G30

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow K^+K^-\pi^+\pi^-\eta) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.2 \pm 1.3 \pm 0.8$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G30;LINKAGE=AU

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{199}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.00±0.33±0.29	287 ± 24	LEES	12F BABR	10.6 e ⁺ e ⁻ → 2(K ⁺ K ⁻)γ

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.11±0.39±0.30	156 ± 15	¹ AUBERT 07AK	BABR	10.6 e ⁺ e ⁻ → 2(K ⁺ K ⁻)γ
4.0 ±0.7 ±0.6	38	² AUBERT 05D	BABR	10.6 e ⁺ e ⁻ → 2(K ⁺ K ⁻)γ

¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

NODE=M070G13
NODE=M070G13

NODE=M070G13;LINKAGE=A
NODE=M070G13;LINKAGE=AU

$$\Gamma(K^+K^-K_S^0K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{200}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3±0.4±0.1	29	LEES	14H BABR	e ⁺ e ⁻ → K _S ⁰ K _S ⁰ K ⁺ K ⁻ γ

NODE=M070GY3
NODE=M070GY3

$$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{207}\Gamma_5/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.9±0.6 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.			

11.3±0.4±0.3	821	¹ LEES	13O BABR	e ⁺ e ⁻ → p $\bar{p}$ γ
12.9±0.4±0.4	918	² LEES	13Y BABR	e ⁺ e ⁻ → p $\bar{p}$ γ
9.7±1.7		³ ARMSTRONG 93B	E760	p $\bar{p}$ → e ⁺ e ⁻

• • • We do not use the following data for averages, fits, limits, etc. • • •

12.0±0.6±0.5	438	⁴ AUBERT	06B BABR	e ⁺ e ⁻ → p $\bar{p}$ γ

¹ ISR photon reconstructed in the detector

² ISR photon undetected

³ Using $\Gamma_{\text{total}} = 85.5^{+6.1}_{-5.8}$ MeV.

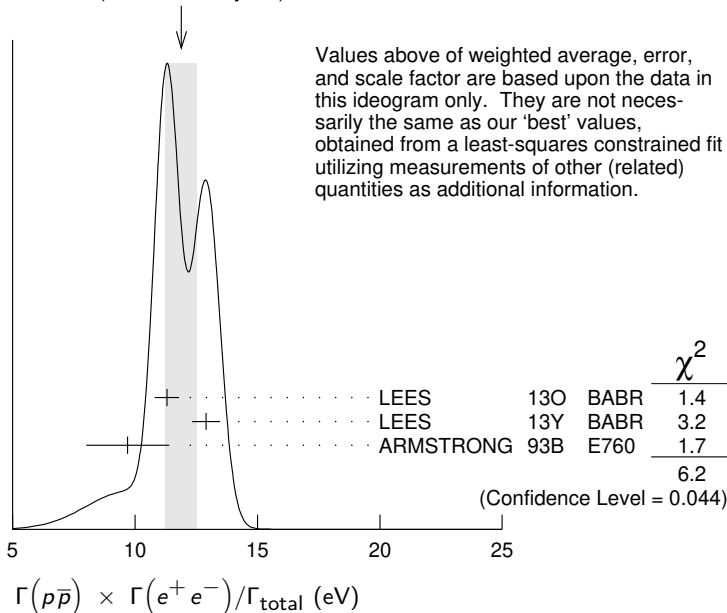
⁴ Superseded by LEES 13O

NODE=M070G4
NODE=M070G4

NODE=M070G4;LINKAGE=B
NODE=M070G4;LINKAGE=C

NODE=M070G;LINKAGE=A
NODE=M070G4;LINKAGE=A

WEIGHTED AVERAGE
11.9±0.6 (Error scaled by 1.8)



$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{223}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
10.7±0.9±0.7	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M070G16
NODE=M070G16

$$\Gamma(\Sigma^+\bar{\Sigma}^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{233}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.8±1.5±0.8	GONG	23	BELL $e^+e^- \rightarrow \Sigma^+\bar{\Sigma}^-$

NODE=M070Q50
NODE=M070Q50

$$\Gamma(\Sigma^0\bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{234}\Gamma_5/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.2±1.5±0.6	GONG	23	BELL $e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0$
6.4±1.2±0.6	AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Sigma^0\bar{\Sigma}^0\gamma$

NODE=M070G17
NODE=M070G17

OCCUR=2

$J/\psi(1S)$ BRANCHING RATIOS

NODE=M070230

For the first four branching ratios, see also the partial widths, and (partial widths) $\times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ above.

NODE=M070300

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.877±0.005 OUR AVERAGE

0.878±0.005	BAI	95B	BES e^+e^-
0.86 ±0.02	BOYARSKI	75	MRK1 e^+e^-

NODE=M070R3
NODE=M070R3

$$\Gamma(\text{virtual}\gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.1346±0.0007 OUR AVERAGE [0.135 ± 0.003 OUR 2023 AVERAGE]

0.1346±0.0007	¹ LIAO	23	RVUE e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.135 ±0.003	^{2,3} SETH	04	RVUE e^+e^-
0.17 ±0.02	² BOYARSKI	75	MRK1 e^+e^-

NODE=M070R4
NODE=M070R4
NEW

¹ Using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (5.967 \pm 0.023)\%$ and $R = 2.26 \pm 0.01$ determined by a fit to data from Mark-I, DM2, BESII, KEDR, and BESIII.

² Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.

³ Using $B(J/\psi \rightarrow \ell^+\ell^-) = (5.90 \pm 0.09)\%$ from RPP-2002 and $R = 2.28 \pm 0.04$ determined by a fit to data from BAI 00 and BAI 02C. Superseded by LIAO 23.

NODE=M070R4;LINKAGE=A

NODE=M070R4;LINKAGE=C
NODE=M070R4;LINKAGE=SE

$$\Gamma(gg)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

64.1±1.0 6 M ¹ BESSON 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^-\text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(gg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the PDG 08 values of $B(\ell^+\ell^-)$, $B(\text{virtual}\gamma \rightarrow \text{hadrons})$, and $B(\gamma\eta_c)$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S65
NODE=M070S65

NODE=M070S65;LINKAGE=BE

$$\Gamma(\gamma gg)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

8.79±1.05 200 k ¹ BESSON 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(gg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the value of $\Gamma(gg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(gg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S66
NODE=M070S66

NODE=M070S66;LINKAGE=BE

$$\Gamma(\gamma gg)/\Gamma(gg) \quad \Gamma_4/\Gamma_3$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

13.7±0.1±0.7 6 M BESSON 08 CLEO $\psi(2S) \rightarrow \pi^+\pi^-J/\psi$

NODE=M070S67
NODE=M070S67

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-2}) EVTS**5.971±0.032 OUR AVERAGE**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.983±0.007±0.037	720k	ABLIKIM	13R BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.945±0.067±0.042	15k	LI	05C CLEO	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.90 ±0.05 ±0.10		BAI	98D BES	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.09 ±0.33		BAI	95B BES	$e^+ e^-$
5.92 ±0.15 ±0.20		COFFMAN	92 MRK3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75 MRK1	$e^+ e^-$

NODE=M070R1
NODE=M070R1 $\Gamma(e^+e^-\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ VALUE (units 10^{-3})**8.8±1.3±0.4**¹ For $E_\gamma > 100$ MeV.

DOCUMENT ID	TECN	COMMENT
¹ ARMSTRONG	96 E760	$\bar{p} p \rightarrow e^+ e^- \gamma$

NODE=M070S33
NODE=M070S33

NODE=M070S33;LINKAGE=A

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-2}) EVTS**5.961±0.033 OUR AVERAGE**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.973±0.007±0.038	770k	ABLIKIM	13R BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.960±0.065±0.050	17k	LI	05C CLEO	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
5.84 ±0.06 ±0.10		BAI	98D BES	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.08 ±0.33		BAI	95B BES	$e^+ e^-$
5.90 ±0.15 ±0.19		COFFMAN	92 MRK3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
6.9 ±0.9		BOYARSKI	75 MRK1	$e^+ e^-$

NODE=M070R2
NODE=M070R2 $\Gamma(e^+e^-)/\Gamma(\mu^+\mu^-)$ Γ_5/Γ_7

VALUE

1.0016±0.0031 OUR AVERAGE

VALUE	DOCUMENT ID	TECN	COMMENT
1.0022±0.0044±0.0048	¹ AULCHENKO 14	KEDR	3.097 $e^+ e^- \rightarrow e^+ e^-, \mu^+ \mu^-$
1.0017±0.0017±0.0033	² ABLIKIM 13R	BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
1.002 ±0.021 ±0.013	³ ANASHIN 10	KEDR	3.097 $e^+ e^- \rightarrow e^+ e^-, \mu^+ \mu^-$
0.997 ±0.012 ±0.006	LI 05C	CLEO	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1.011 ±0.013 ±0.016	BAI 98D	BES	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
1.00 ±0.07	BAI 95B	BES	$e^+ e^-$
1.00 ±0.05	BOYARSKI 75	MRK1	$e^+ e^-$
0.91 ±0.15	ESPOSITO 75B	FRAM	$e^+ e^-$
0.93 ±0.10	FORD 75	SPEC	$e^+ e^-$

NODE=M070R5
NODE=M070R5¹ From 235.3k $J/\psi \rightarrow e^+ e^-$ and 156.6k $J/\psi \rightarrow \mu^+ \mu^-$ observed events.² Not independent of the corresponding measurements of $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$.³ Not independent of the corresponding measurements of $\Gamma(e^+e^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ and $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$.NODE=M070R5;LINKAGE=A
NODE=M070R5;LINKAGE=AB

NODE=M070R5;LINKAGE=AN

HADRONIC DECAYS

NODE=M070305

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_8/Γ VALUE (units 10^{-2}) EVTS**1.88 ±0.12 OUR AVERAGE**

Error includes scale factor of 2.6. See the ideogram below.

[(1.69 ± 0.15) × 10⁻² OUR 2023 AVERAGE Scale factor = 2.4]

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.072±0.017±0.062	19.8k	¹ ANASHIN	23 KEDR	$e^+ e^- \rightarrow J/\psi \rightarrow \pi^+ \pi^- \pi^0$
2.18 ±0.19		^{2,3} AUBERT,B	04N BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$
2.184±0.005±0.201	220k	^{3,4} BAI	04H BES	$e^+ e^- \rightarrow J/\psi \rightarrow \pi^+ \pi^- \pi^0$
2.091±0.021±0.116		^{3,5} BAI	04H BES	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
1.21 ±0.20		BAI	96D BES	$e^+ e^- \rightarrow \rho \pi$
1.42 ±0.01 ±0.19		COFFMAN	88 MRK3	$e^+ e^-$
1.3 ±0.3	150	FRANKLIN	83 MRK2	$e^+ e^-$
1.6 ±0.4	183	ALEXANDER	78 PLUT	$e^+ e^-$
1.33 ±0.21		BRANDELIK	78B DASP	$e^+ e^-$
1.0 ±0.2	543	BARTEL	76 CNTR	$e^+ e^-$
1.3 ±0.3	153	JEAN-MARIE	76 MRK1	$e^+ e^-$

NODE=M070R20
NODE=M070R20

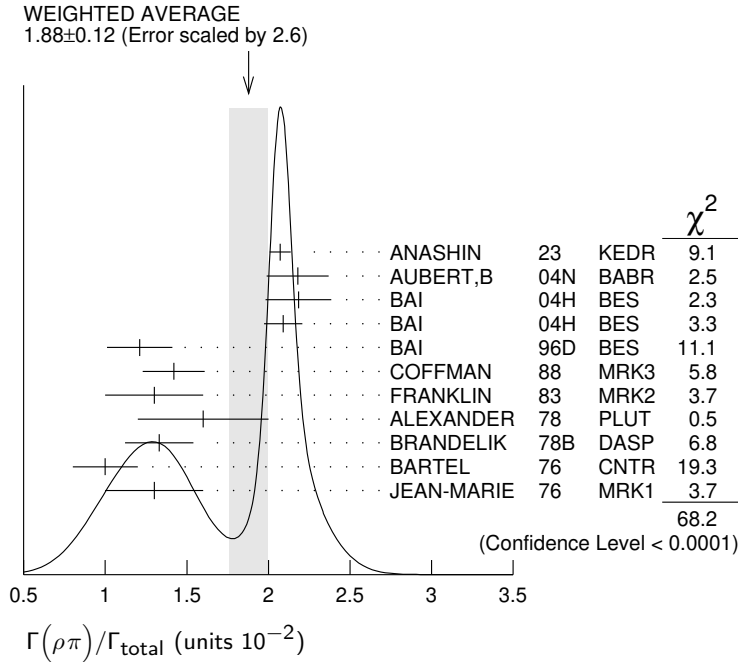
NEW

OCCUR=2

- ¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0\pi^0$, $J/\psi \rightarrow \rho^+\pi^-$, $J/\psi \rightarrow \rho^-\pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.
- ² From the ratio of $\Gamma(e^+e^-)B(\pi^+\pi^-\pi^0)$ and $\Gamma(e^+e^-)B(\mu^+\mu^-)$ (AUBERT 04).
- ³ Not independent of their $B(\pi^+\pi^-\pi^0)$.
- ⁴ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.
- ⁵ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^-J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R20;LINKAGE=A

NODE=M070R20;LINKAGE=AU
 NODE=M070R20;LINKAGE=BU
 NODE=M070R20;LINKAGE=BA
 NODE=M070R20;LINKAGE=BI

 $\Gamma(\rho\pi)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_8/Γ_{163}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.142 \pm 0.011 \pm 0.026$	20k	¹ LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.331 ± 0.033	20k	² LEES	17C	BABR $J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070P18
 NODE=M070P18

OCCUR=2

NODE=M070P18;LINKAGE=A
 NODE=M070P18;LINKAGE=B

 $\Gamma(\rho^0\pi^0)/\Gamma(\rho\pi)$ Γ_9/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT
$0.328 \pm 0.005 \pm 0.027$	COFFMAN 88	MRK3	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.35 ± 0.08	ALEXANDER 78	PLUT	e^+e^-
0.32 ± 0.08	BRANDELIK 78B	DASP	e^+e^-
0.39 ± 0.11	BARTEL 76	CNTR	e^+e^-
0.37 ± 0.09	JEAN-MARIE 76	MRK1	e^+e^-

NODE=M070R21
 NODE=M070R21

 $\Gamma(\rho^+K^+K^-\pi^- + c.c \rightarrow K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.53 \pm 0.16 \pm 0.81$	485	ANASHIN 22	KEDR	$J/\psi \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M070Q41
 NODE=M070Q41

 $\Gamma(a_2(1320)^0\pi^+\pi^- \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.84 \pm 0.08 \pm 0.60$	1317	ANASHIN 22	KEDR	$J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$

NODE=M070Q39
 NODE=M070Q39

 $\Gamma(a_2(1320)^+\pi^-\pi^0 + c.c \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.67 \pm 0.09 \pm 0.73$	1628	ANASHIN 22	KEDR	$J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$

NODE=M070Q40
 NODE=M070Q40

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**10.9±2.2 OUR AVERAGE**

11.7±0.7±2.5 7584

8.4±4.5 36

DOCUMENT ID

TECN

COMMENT

AUGUSTIN 89

DM2

 $J/\psi \rightarrow \rho^0 \rho^\pm \pi^\mp$

VANNUCCI 77

MRK1

 $e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$ Γ_{12}/Γ

NODE=M070R43

NODE=M070R43

 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**3.78±0.68**

471

DOCUMENT ID

TECN

COMMENT

¹ ABLIKIM

19Q

BES3

 $e^+e^- \rightarrow J/\psi \rightarrow \eta\pi^+\pi^-$ ¹ From an energy scan of $e^+e^- \rightarrow J/\psi \rightarrow \eta\pi^+\pi^-$ assuming PDG 16 values for $\Gamma(e^+e^-)$, $\Gamma(\mu^+\mu^-)$, and $\Gamma(\text{total})$. Γ_{13}/Γ

NODE=M070P81

NODE=M070P81

NODE=M070P81;LINKAGE=A

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**0.193±0.023 OUR AVERAGE**

0.194±0.017±0.029 299

0.193±0.013±0.029

DOCUMENT ID

TECN

COMMENT

JOUSSET

90

DM2

 $J/\psi \rightarrow \text{hadrons}$

COFFMAN

88

MRK3

 $e^+e^- \rightarrow \pi^+\pi^-\eta$ Γ_{14}/Γ

NODE=M070R22

NODE=M070R22

 $\Gamma(\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**1.20±0.14±0.37**

471

DOCUMENT ID

TECN

COMMENT

ABLIKIM

15H

BES3

 $e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$ Γ_{17}/Γ

NODE=M070B12

NODE=M070B12

 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE CL%

<2.52 × 10⁻⁴

90

DOCUMENT ID

TECN

COMMENT

ABLIKIM

10C

BES2

 $J/\psi \rightarrow \eta K^+\pi^- K^- \pi^+$ Γ_{18}/Γ

NODE=M070S70

NODE=M070S70

 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**21.8±2.2±3.4**

232 ± 23

DOCUMENT ID

TECN

COMMENT

ABLIKIM

08E

BES2

 $e^+e^- \rightarrow J/\psi$ Γ_{20}/Γ

NODE=M070S57

NODE=M070S57

 $\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.15±0.13±0.22**

209

DOCUMENT ID

TECN

COMMENT

ABLIKIM

10C

BES2

 $J/\psi \rightarrow \eta K^+\pi^- K^- \pi^+$ Γ_{21}/Γ

NODE=M070S69

NODE=M070S69

 $\Gamma(\rho\eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS**8.1 ±0.8 OUR AVERAGE**

Error includes scale factor of 1.6.

7.90±0.19±0.49 3476

8.3 ±3.0 ±1.2 19

11.4 ±1.4 ±1.6

DOCUMENT ID

TECN

COMMENT

¹ ABLIKIM

17AK

BES3

 $J/\psi \rightarrow \pi^+\pi^-\eta'$

JOUSSET

90

DM2

 $J/\psi \rightarrow \text{hadrons}$

COFFMAN

88

MRK3

 $J/\psi \rightarrow \pi^+\pi^-\eta'$ ¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+\pi^-\eta'$. Γ_{22}/Γ

NODE=M070R23

NODE=M070R23

NODE=M070R23;LINKAGE=A

 $\Gamma(\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**2.2±0.2±1.1**

19.8k

DOCUMENT ID

TECN

COMMENT

¹ ANASHIN

23

KEDR

 $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$ Γ_{30}/Γ

NODE=M070Q49

NODE=M070Q49

¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0\pi^0$, $J/\psi \rightarrow \rho^+\pi^-$, $J/\psi \rightarrow \rho^-\pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.

NODE=M070Q49;LINKAGE=A

 $\Gamma(\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$

VALUE (%) EVTS

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.9 ±1.7 ±2.7 20k

0.80±0.27 20k

DOCUMENT ID

TECN

COMMENT

¹ LEES

17C

BABR

 $J/\psi \rightarrow \pi^+\pi^-\pi^0$ ² LEES

17C

BABR

 $J/\psi \rightarrow \pi^+\pi^-\pi^0$ Γ_{30}/Γ_{163}

NODE=M070P25

NODE=M070P25

OCCUR=2

¹ From a Dalitz plot analysis in an isobar model.² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P25;LINKAGE=A

NODE=M070P25;LINKAGE=B

 $\Gamma(\rho(1450)^\pm \pi^\mp \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$

VALUE (%) EVTS

6.3±0.8±0.6

4k

DOCUMENT ID

TECN

COMMENT

¹ LEES

17C

BABR

 $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$ Γ_{31}/Γ_{181}

NODE=M070P31

NODE=M070P31

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P31;LINKAGE=A

$$\Gamma(\rho(1450)^0 \pi^0 \rightarrow K^+ K^- \pi^0) / \Gamma(K^+ K^- \pi^0) \quad \Gamma_{32}/\Gamma_{180}$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
9.3 ± 2.0 ± 0.6	2k	¹ LEES	17C BABR	$J/\psi \rightarrow K^+ K^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P27
NODE=M070P27

NODE=M070P27;LINKAGE=A

$$\Gamma(\rho(1450) \eta'(958) \rightarrow \pi^+ \pi^- \eta'(958)) / \Gamma_{\text{total}} \quad \Gamma_{33}/\Gamma$$

VALUE (units 10 ⁻⁶)	EVTS	DOCUMENT ID	TECN	COMMENT
3.28 ± 0.55 ± 0.44	119	¹ ABLIKIM	17AK BES3	$J/\psi \rightarrow \pi^+ \pi^- \eta'$

¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+ \pi^- \eta'$.

NODE=M070P36
NODE=M070P36

NODE=M070P36;LINKAGE=A

$$\Gamma(\rho(1700) \pi \rightarrow \pi^+ \pi^- \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{35}/\Gamma_{163}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
8 ± 2 ± 5	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22 ± 6	20k	² LEES	17C BABR	$J/\psi \rightarrow \pi^+ \pi^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P21
NODE=M070P21

OCCUR=2

NODE=M070P21;LINKAGE=A
NODE=M070P21;LINKAGE=B

$$\Gamma(\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{37}/\Gamma_{163}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
4 ± 1 ± 20	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
600 ± 250	20k	² LEES	17C BABR	$J/\psi \rightarrow \pi^+ \pi^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

² From a Dalitz plot analysis in a Veneziano model.

NODE=M070P22
NODE=M070P22

OCCUR=2

NODE=M070P22;LINKAGE=A
NODE=M070P22;LINKAGE=B

$$\Gamma(\rho_3(1690) \pi \rightarrow \pi^+ \pi^- \pi^0) / \Gamma(\pi^+ \pi^- \pi^0) \quad \Gamma_{38}/\Gamma_{163}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 0.8	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+ \pi^- \pi^0$

¹ From a Dalitz plot analysis in a Veneziano model.

NODE=M070P24
NODE=M070P24

NODE=M070P24;LINKAGE=A

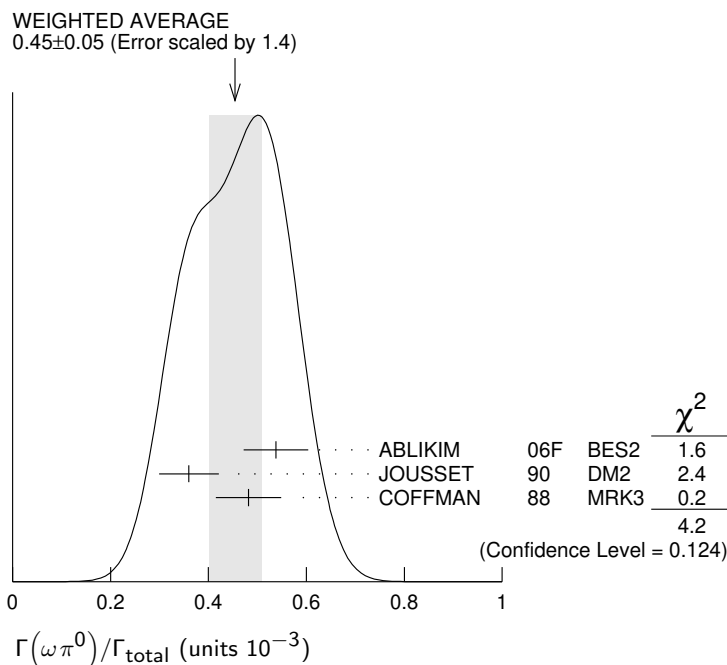
$$\Gamma(\omega \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{39}/\Gamma$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
0.45 ± 0.05 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
0.538 ± 0.012 ± 0.065	2090	¹ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega \pi^0$
0.360 ± 0.028 ± 0.054	222	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.482 ± 0.019 ± 0.064		COFFMAN	88 MRK3	$e^+ e^- \rightarrow \pi^0 \pi^+ \pi^- \pi^0$

¹ Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R32
NODE=M070R32

NODE=M070R32;LINKAGE=BL



$$\Gamma(\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$$

$$\Gamma_{40}/\Gamma_{163}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8 \pm 3 \pm 2$	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$

¹ From a Dalitz plot analysis in an isobar model and significance 4.9σ .

NODE=M070P23
NODE=M070P23

NODE=M070P23;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{41}/\Gamma$$

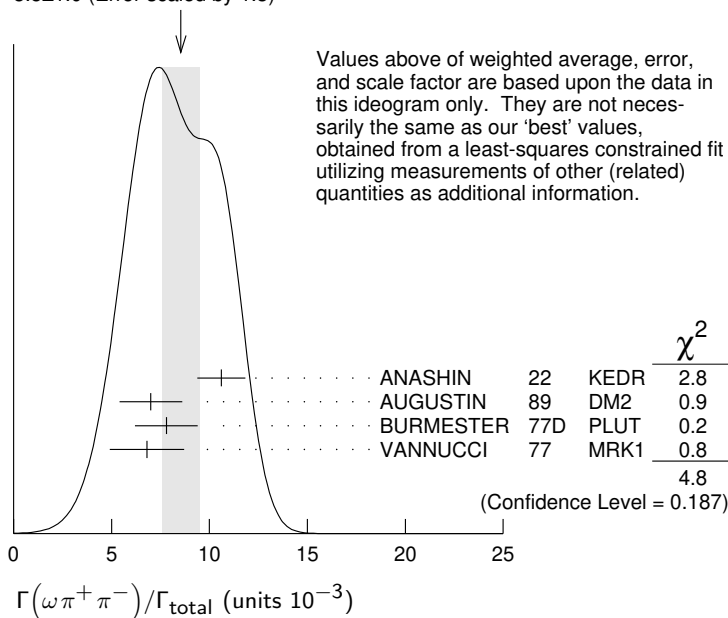
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 ± 1.0 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
$10.6 \pm 1.2 \pm 0.1$	3531	¹ ANASHIN	22 KEDR	$J/\psi \rightarrow 2(\pi^+\pi^-)\pi^0$
7.0 ± 1.6	18058	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+\pi^-)\pi^0$
7.8 ± 1.6	215	BURMESTER	77D PLUT	e^+e^-
6.8 ± 1.9	348	VANNUCCI	77 MRK1	$e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$

¹ ANASHIN 22 reports $[\Gamma(J/\psi(1S) \rightarrow \omega\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = (0.946 \pm 0.016 \pm 0.108) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R24
NODE=M070R24

NODE=M070R24;LINKAGE=A

WEIGHTED AVERAGE
 8.5 ± 1.0 (Error scaled by 1.3)



$$\Gamma(\omega\pi^0\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{42}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.4 \pm 0.3 \pm 0.7$	509	AUGUSTIN	89 DM2	$J/\psi \rightarrow \pi^+\pi^-\pi^0$

NODE=M070S26
NODE=M070S26

$$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$$

$$\Gamma_{44}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3 ± 0.6 OUR AVERAGE				
$4.3 \pm 0.2 \pm 0.6$	5860	AUGUSTIN	89 DM2	e^+e^-
4.0 ± 1.6	70	BURMESTER	77D PLUT	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.9 ± 0.8	81	VANNUCCI	77 MRK1	$e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M070R28
NODE=M070R28

$$\Gamma(\omega\eta)/\Gamma_{\text{total}}$$

$$\Gamma_{45}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.74 ± 0.20 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
2.352 ± 0.273	5k	¹ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\eta$
$1.44 \pm 0.40 \pm 0.14$	13	² AUBERT	06D BABR	$10.6 e^+e^- \rightarrow \omega\eta\gamma$
$1.43 \pm 0.10 \pm 0.21$	378	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$1.71 \pm 0.08 \pm 0.20$		COFFMAN	88 MRK3	$e^+e^- \rightarrow 3\pi\eta$

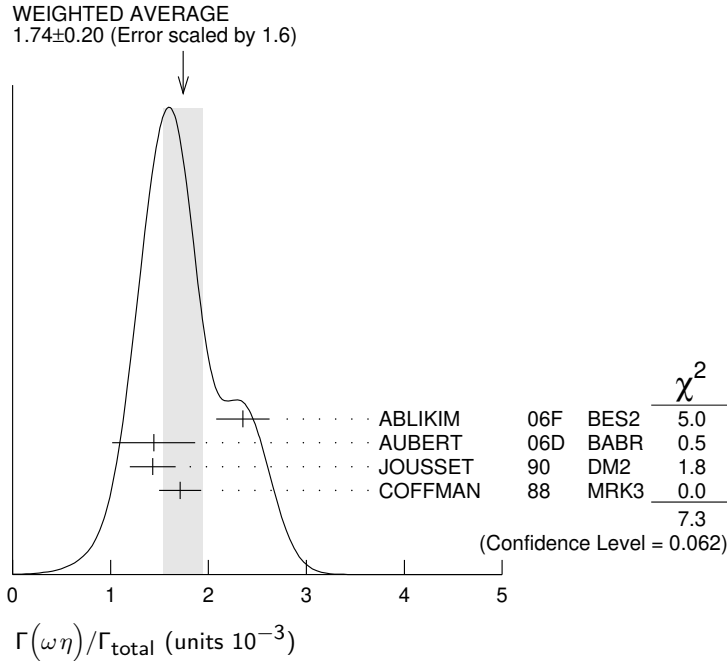
NODE=M070R30
NODE=M070R30

¹ Using $B(\eta \rightarrow 2\gamma) = (39.43 \pm 0.26)\%$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = 22.6 \pm 0.4\%$, $B(\eta \rightarrow \pi^+\pi^-\gamma) = 4.68 \pm 0.11\%$, and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

² Using $\Gamma(J/\psi \rightarrow e^+e^-) = 5.52 \pm 0.14 \pm 0.04$ keV.

NODE=M070R30;LINKAGE=BL

NODE=M070R30;LINKAGE=EE



$\Gamma(\omega\pi^+\pi^+\pi^-\pi^-)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
85±34	140	VANNUCCI	77	MRK1 $e^+e^- \rightarrow 3(\pi^+\pi^-)\pi^0$

NODE=M070R26
NODE=M070R26

$\Gamma(\omega\eta'\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.12±0.02±0.13	14k	¹ ABLIKIM	19AC BES3	$J/\psi \rightarrow \omega\eta'\pi^+\pi^-$

NODE=M070P83
NODE=M070P83

¹ Using the decays $\omega \rightarrow \pi^+\pi^-\pi^0$ and $\eta' \rightarrow \eta\pi^+\pi^-$.

NODE=M070P83;LINKAGE=A

$\Gamma(\omega\eta'(958))/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.89±0.18 OUR AVERAGE				
2.08±0.30±0.14	137	¹ ABLIKIM	17AK BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'$
2.26±0.43	218	² ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\eta'$
1.8 $^{+1.0}_{-0.8}$ ±0.3	6	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
1.66±0.17±0.19		COFFMAN	88 MRK3	$e^+e^- \rightarrow 3\pi\eta'$

NODE=M070R31
NODE=M070R31

¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+\pi^-\eta'$.

² Using $B(\eta' \rightarrow \pi^+\pi^-\eta) = (44.3 \pm 1.5)\%$, $B(\eta' \rightarrow \pi^+\pi^-\gamma) = 29.5 \pm 1.0\%$, $B(\eta \rightarrow 2\gamma) = 39.43 \pm 0.26\%$, and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R31;LINKAGE=A
NODE=M070R31;LINKAGE=BL

$\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.41±0.27±0.47	¹ AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+\pi^-)\pi^0$

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070S27
NODE=M070S27

NODE=M070S27;LINKAGE=K

$\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.8±1.1±0.3	^{1,2} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

² Addition of $f_0(1710) \rightarrow K^+K^-$ and $f_0(1710) \rightarrow K^0\bar{K}^0$ branching ratios.

NODE=M070S25
NODE=M070S25

NODE=M070S25;LINKAGE=F
NODE=M070S25;LINKAGE=G

$\Gamma(\omega f_1(1420))/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
6.8±1.9±1.7	111 $^{+31}_{-26}$	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S5
NODE=M070S5

$\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-4}$	90	¹ VANNUCCI 77	MRK1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<2.8 \times 10^{-4}$	90	¹ FALVARD 88	DM2	$J/\psi \rightarrow \text{hadrons}$
¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.				

NODE=M070R29
NODE=M070R29

NODE=M070R29;LINKAGE=C

 $\Gamma(\omega X(1835) \rightarrow \omega p \bar{p})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.9 \times 10^{-6}$	95	ABLIKIM 13P	BES3	$J/\psi \rightarrow \gamma \pi^0 p \bar{p}$

NODE=M070S81
NODE=M070S81

 $\Gamma(\omega X(1835), X \rightarrow \eta' \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$<6.2 \times 10^{-5}$	¹ ABLIKIM 19AC	BES3	$J/\psi \rightarrow \omega \eta' \pi^+ \pi^-$

NODE=M070P84
NODE=M070P84

¹ Using the decays $\omega \rightarrow \pi^+\pi^-\pi^0$ and $\eta' \rightarrow \eta \pi^+ \pi^-$.

NODE=M070P84;LINKAGE=A

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.52 \pm 0.30 \pm 0.01$	276	¹ ANASHIN 22	KEDR	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M070Q38
NODE=M070Q38

¹ ANASHIN 22 reports $[\Gamma(J/\psi(1S) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0)] = (0.136 \pm 0.008 \pm 0.026) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070Q38;LINKAGE=A

 $\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
34 $\pm$ 5 OUR AVERAGE				
$37.7 \pm 0.8 \pm 5.8$	1972 ± 41	ABLIKIM	08E BES2	$e^+e^- \rightarrow J/\psi$
$29.5 \pm 1.4 \pm 7.0$	879 ± 41	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S1
NODE=M070S1

 $\Gamma(\omega K \bar{K})/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19 $\pm$ 4 OUR AVERAGE				
$19.8 \pm 2.1 \pm 3.9$		¹ FALVARD 88	DM2	$J/\psi \rightarrow \text{hadrons}$
16 ± 10	22	FELDMAN 77	MRK1	e^+e^-

NODE=M070R27
NODE=M070R27

¹ Addition of $\omega K^+ K^-$ and $\omega K^0 \bar{K}^0$ branching ratios.

NODE=M070R27;LINKAGE=B

 $\Gamma(\omega K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 $\pm$ 9 OUR AVERAGE				
$62.0 \pm 6.8 \pm 10.6$	899 ± 98	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp$
$65.3 \pm 10.2 \pm 13.5$	176 ± 28	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
$53 \pm 14 \pm 14$	530 ± 140	BECKER	87 MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S2
NODE=M070S2

OCCUR=2

 $\Gamma(\eta' K^{*\pm} K^\mp)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.48 $\pm$ 0.13 OUR AVERAGE			
$1.50 \pm 0.02 \pm 0.19$	¹ ABLIKIM 18AB	BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$
$1.47 \pm 0.03 \pm 0.17$	² ABLIKIM 18AB	BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$

NODE=M070P48
NODE=M070P48

OCCUR=2

¹ From $\eta' K^+ K^- \pi^0$.

² From $\eta' K_S^0 K^\pm \pi^\mp$.

NODE=M070P48;LINKAGE=A
NODE=M070P48;LINKAGE=B

 $\Gamma(\eta' K^{*0} \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.66 $\pm$ 0.03 $\pm$ 0.21	¹ ABLIKIM 18AB	BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$

NODE=M070P49
NODE=M070P49

¹ From $\eta' K_S^0 K^\pm \pi^\mp$.

NODE=M070P49;LINKAGE=A

 $\Gamma(\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.16 $\pm$ 0.12 $\pm$ 0.29	1.1k	¹ ABLIKIM 18AB	BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$

NODE=M070P52
NODE=M070P52

¹ From $\eta' K_S^0 K^\pm \pi^\mp$.

NODE=M070P52;LINKAGE=A

$$\Gamma(\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp) / \Gamma_{\text{total}} \quad \Gamma_{65}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.51 \pm 0.09 \pm 0.21$	1.0k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K^+ K^- \pi^0$.				

NODE=M070P44
NODE=M070P44

NODE=M070P44;LINKAGE=A

$$\Gamma(\eta' h_1(1415) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}} \quad \Gamma_{66}/\Gamma$$

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
$4.69 \pm 0.80^{+0.74}_{-1.82}$	¹ ABLIKIM	22C BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

NODE=M070Q28
NODE=M070Q28

NODE=M070Q28;LINKAGE=A

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

$$\Gamma(h_1(1415) \eta' \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.08 \pm 0.01^{+0.01}_{-0.02}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

NODE=M070Q33
NODE=M070Q33

NODE=M070Q33;LINKAGE=A

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

$$\Gamma(h_1(1595) \eta' \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.16 \pm 0.02^{+0.03}_{-0.01}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

NODE=M070Q34
NODE=M070Q34

NODE=M070Q34;LINKAGE=A

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

$$\Gamma(\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp) / \Gamma(K_S^0 K^\pm \pi^\mp) \quad \Gamma_{68}/\Gamma_{181}$$

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
$90.5 \pm 0.9 \pm 3.8$	4k	¹ LEES	17C BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M070P30
NODE=M070P30

NODE=M070P30;LINKAGE=A

¹ From a Dalitz plot analysis in an isobar model.

$$\Gamma(K^+ K^*(892)^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{69}/\Gamma$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$6.0^{+0.8}_{-1.0}$	OUR AVERAGE Error includes scale factor of 2.9. See the ideogram below.			

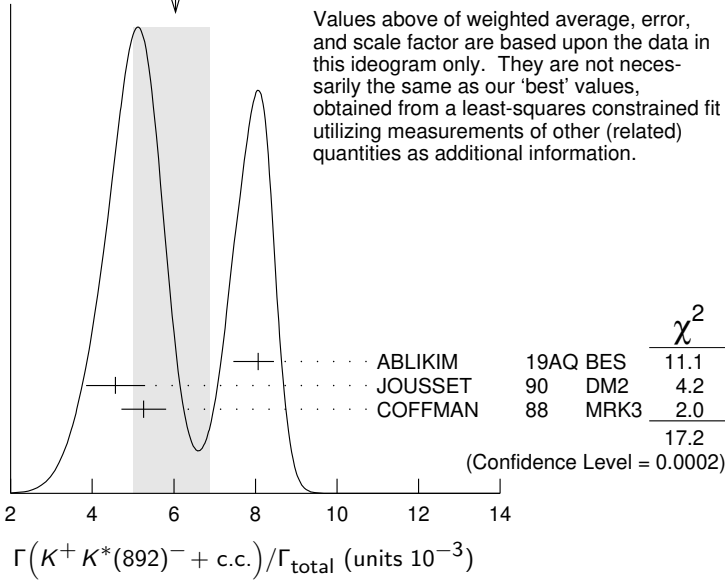
NODE=M070S15
NODE=M070S15

$8.07 \pm 0.04^{+0.38}_{-0.61}$	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
$4.57 \pm 0.17 \pm 0.70$	2285	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$5.26 \pm 0.13 \pm 0.53$		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp, K^+ K^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.6 ± 0.6	24	FRANKLIN	83 MRK2	$J/\psi \rightarrow K^+ K^- \pi^0$
3.2 ± 0.6	48	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
4.1 ± 1.2	39	BRAUNSCH...	76 DASP	$J/\psi \rightarrow K^\pm X$

WEIGHTED AVERAGE
6.0±0.8-1.0 (Error scaled by 2.9)



$\Gamma(K^+K^*(892)^- + c.c. \rightarrow K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.69±0.01^{+0.13}_{-0.20}	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+K^-\pi^0$

NODE=M070P79
NODE=M070P79

$\Gamma(K^+K^*(892)^- + c.c. \rightarrow K^+K^-\pi^0)/\Gamma(K^+K^-\pi^0)$ Γ_{70}/Γ_{180}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
92.4±1.5±3.4	2k	¹ LEES	17C BABR	$J/\psi \rightarrow K^+K^-\pi^0$

NODE=M070P26
NODE=M070P26

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P26;LINKAGE=A

$\Gamma(K^0\bar{K}^*(892)^0 + c.c.)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ±0.4 OUR AVERAGE				
3.96±0.15±0.60	1192	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
4.33±0.12±0.45		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.7 ±0.6	45	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$

NODE=M070S16
NODE=M070S16

$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + c.c.)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
5.73±0.14±0.82	¹ ANASHIN	22 KEDR	$J/\psi \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	² ABLIKIM	06C BES2	$J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$

NODE=M070S52
NODE=M070S52

¹ Obtained from $J/\psi \rightarrow K^*(892)K^-\pi^+ + c.c. \rightarrow K^+K^-\pi^+\pi^-$ taking the value 2/3 for the probability of the $K^*(892)^0 \rightarrow K^+\pi^-$ decay.

NODE=M070S52;LINKAGE=A

² A $K_0^*(700)$ is observed by ABLIKIM 06C in the $K^+\pi^-$ mass spectrum of the $\bar{K}^*(892)^0 K^+\pi^-$ final state against the $\bar{K}^*(892)$. A corresponding branching fraction of the $J/\psi(1S)$ is not presented.

NODE=M070S52;LINKAGE=AB

$\Gamma(K^*(892)^0 K^-\pi^+ + c.c. \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.81±0.10±0.54	1559	ANASHIN	22 KEDR	$J/\psi \rightarrow K^+K^-\pi^+\pi^-$

NODE=M070Q42
NODE=M070Q42

$\Gamma(K^*(892)^0 K_S^0 \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
6.28^{+0.16+0.59}_{-0.17-0.52}	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P71
NODE=M070P71

$\Gamma(K^*(892)^\pm K^*(700)^\mp)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.18^{+0.94}_{-0.54}	655	ABLIKIM	10E BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S74
NODE=M070S74

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$
 Γ_{82}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5	90	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M070R46
NODE=M070R46

 $\Gamma(K^*(892)^\pm K^*(892)^\mp)/\Gamma_{\text{total}}$
 Γ_{83}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

$1.00 \pm 0.19^{+0.11}_{-0.32}$	323	ABLIKIM	10E	BES2	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$

NODE=M070S73
NODE=M070S73

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$
 Γ_{84}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

$3.8 \pm 0.8 \pm 1.2$	¹ BAI	99C	BES	$e^+ e^-$

¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$

NODE=M070S35
NODE=M070S35

NODE=M070S35;LINKAGE=M3

 $\Gamma(K^*(1410) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$
 Γ_{86}/Γ_{180}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

$2.3 \pm 1.1 \pm 0.7$	2k	¹ LEES	17C	BABR	$J/\psi \rightarrow K^+ K^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P28
NODE=M070P28

NODE=M070P28;LINKAGE=A

 $\Gamma(K^*(1410) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$
 Γ_{87}/Γ_{181}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

$1.5 \pm 0.5 \pm 0.9$	4k	¹ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P32
NODE=M070P32

NODE=M070P32;LINKAGE=A

 $\Gamma(K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$
 Γ_{89}/Γ_{180}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

$3.5 \pm 1.3 \pm 0.9$	2k	¹ LEES	17C	BABR	$J/\psi \rightarrow K^+ K^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P29
NODE=M070P29

NODE=M070P29;LINKAGE=A

 $\Gamma(K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$
 Γ_{90}/Γ_{181}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

$7.1 \pm 1.3 \pm 1.2$	4k	¹ LEES	17C	BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P33
NODE=M070P33

NODE=M070P33;LINKAGE=A

 $\Gamma(\bar{K}_2^*(1430) K + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{91}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 40×10^{-4}	90	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow K^0 \bar{K}_2^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 66×10^{-4}	90	BRAUNSCH...	76	DASP	$e^+ e^- \rightarrow K^\pm \bar{K}_2^{*\mp}$

NODE=M070R45
NODE=M070R45

 $\Gamma(K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{92}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

$2.69 \pm 0.04^{+0.25}_{-0.19}$	183k	ABLIKIM	19AQ	BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P76
NODE=M070P76

 $\Gamma(\bar{K}_2^*(1430)^0 K^*(892)^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{95}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.7 ± 2.6	40	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M070R48
NODE=M070R48

 $\Gamma(K_2^*(1430)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$
 Γ_{98}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 29×10^{-4}	90	VANNUCCI	77	MRK1	$e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M070R47
NODE=M070R47

 $\Gamma(K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{100}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

$1.1 \pm 0.1^{+0.6}_{-0.1}$	183k	ABLIKIM	19AQ	BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P77
NODE=M070P77

$\Gamma(K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{101}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.2 \pm 0.7^{+2.8}_{-1.4}$	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P78
NODE=M070P78

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$
 Γ_{102}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.0 \times 10^{-3}$	90	¹ BAI	99C BES	$e^+ e^-$

NODE=M070S34
NODE=M070S34

¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$

NODE=M070S34;LINKAGE=M2

 $\Gamma(K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$
 Γ_{103}/Γ

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
$8.54^{+1.07+2.35}_{-1.20-2.13}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P72
NODE=M070P72

 $\Gamma(a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}$
 Γ_{104}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<43 \times 10^{-4}$	90	BRAUNSCH...	76 DASP	$e^+ e^-$

NODE=M070R42
NODE=M070R42

 $\Gamma(\phi \pi^0)/\Gamma_{\text{total}}$
 Γ_{105}/Γ

The two different fit values of ABLIKIM 15K below have the same statistical significance of 6.4 σ and cannot be distinguished at this moment.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.94 \pm 0.16 \pm 0.16$		0.8k	¹ ABLIKIM	15K BES3	$e^+ e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$
$0.124 \pm 0.033 \pm 0.030$		35 $\pm$ 9	² ABLIKIM	15K BES3	$e^+ e^- \rightarrow J/\psi \rightarrow K^+ K^- \gamma \gamma$

NODE=M070R33

NODE=M070R33

NODE=M070R33

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.4	90	³ ABLIKIM	05B BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \gamma \gamma$
<6.8	90	COFFMAN	88 MRK3	$e^+ e^- \rightarrow K^+ K^- \pi^0$

¹ Corresponding to one of the two fit solutions with $\delta = (-95.9 \pm 1.5)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

² Corresponding to one of the two fit solutions with $\delta = (-152.1 \pm 7.7)^\circ$ for the phase angle between the resonant $J/\psi \rightarrow \phi \pi^0$ and non-phi $J/\psi \rightarrow K^+ K^- \pi^0$ contributions.

³ Superseded by ABLIKIM 15K.

NODE=M070R33;LINKAGE=A

NODE=M070R33;LINKAGE=C

NODE=M070R33;LINKAGE=B

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{106}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.94 $\pm$ 0.15 OUR AVERAGE		Error includes scale factor of 1.7.		
$1.09 \pm 0.02 \pm 0.13$		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$0.78 \pm 0.03 \pm 0.12$		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
2.1 ± 0.9	23	FELDMAN	77 MRK1	$e^+ e^-$

NODE=M070R34
NODE=M070R34

 $\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$
 Γ_{108}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
16.0 $\pm$ 1.0 $\pm$ 3.0	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070R35
NODE=M070R35

 $\Gamma(\phi \eta)/\Gamma_{\text{total}}$
 Γ_{109}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.74 $\pm$ 0.06 OUR AVERAGE		Error includes scale factor of 1.2.		
$0.71 \pm 0.10 \pm 0.05$	99 $\pm$ 14	¹ ZHU	23 BELL	$e^+ e^- \rightarrow \gamma(\text{nS}) \rightarrow \phi \eta \gamma$
$0.898 \pm 0.024 \pm 0.089$		ABLIKIM	05B BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \text{hadr}$
$0.64 \pm 0.04 \pm 0.11$	346	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
$0.661 \pm 0.045 \pm 0.078$		COFFMAN	88 MRK3	$e^+ e^- \rightarrow K^+ K^- \eta$

NODE=M070R37
NODE=M070R37

¹ From a fit to the combined $\phi \eta$ invariant mass spectrum with a Gaussian function for the J/ψ signals and a second-order polynomial function for the backgrounds.

NODE=M070R37;LINKAGE=A

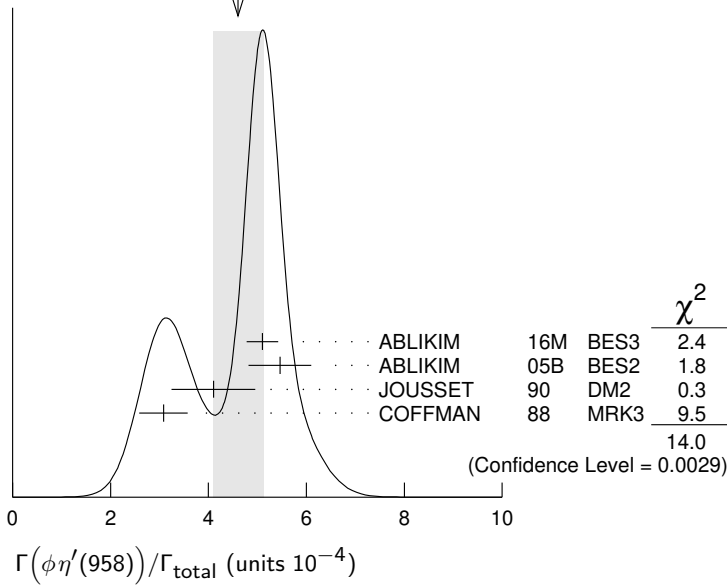
$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
4.6 ± 0.5					OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.
5.10 ± 0.03 ± 0.32		31k	ABLIKIM	16M BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
5.46 ± 0.31 ± 0.56			ABLIKIM	05B BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
4.1 ± 0.3 ± 0.8		167	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
3.08 ± 0.34 ± 0.36			COFFMAN	88 MRK3	$e^+e^- \rightarrow K^+K^-\eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 13		90	VANNUCCI	77 MRK1	e^+e^-

 Γ_{110}/Γ

NODE=M070R38
NODE=M070R38

WEIGHTED AVERAGE
4.6 ± 0.5 (Error scaled by 2.2)

 $\Gamma(\phi\eta\eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.32 ± 0.06 ± 0.16	2.2k	¹ ABLIKIM	19AN BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

 Γ_{111}/Γ

NODE=M070P85
NODE=M070P85

¹ Including contributions from intermediate resonances. Evidence for an intermediate resonance at $M \approx 2 \text{ GeV}$ and $\Gamma \approx 150 \text{ MeV}$ decaying to $\phi\eta'$ with $J^P = 1^+$ or $J^P = 1^-$, and $B(J/\psi \rightarrow \eta X) \times B(X \rightarrow \phi\eta') \approx 10^{-4}$.

NODE=M070P85;LINKAGE=A

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.9				OUR AVERAGE Error includes scale factor of 1.9.
4.6 ± 0.4 ± 0.8		¹ FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
2.6 ± 0.6	50	¹ GIDAL	81 MRK2	$J/\psi \rightarrow K^+K^-K^+K^-$

 Γ_{112}/Γ

NODE=M070R41
NODE=M070R41

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.

NODE=M070R41;LINKAGE=A

 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
4.50 ± 0.80 ± 0.61	355	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$

 Γ_{115}/Γ

NODE=M070S97
NODE=M070S97

 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\rho^0\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
1.67 ± 0.50 ± 0.24	70	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+K^-3\pi$

 Γ_{116}/Γ

NODE=M070S98
NODE=M070S98

 $\Gamma(\phi f_0(980)\eta \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.23 ± 0.75 ± 0.73	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta\phi f_0(980)$

 Γ_{117}/Γ

NODE=M070R08
NODE=M070R08

$\Gamma(\phi a_0(980)^0 \rightarrow \phi \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{118}/Γ VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

4.37±1.35¹ ABLIKIM 18D BES3 $J/\psi \rightarrow \phi \eta \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.0 ±2.7 ±2.5

² ABLIKIM 11D BES3 $J/\psi \rightarrow \phi \eta \pi^0$

¹ Assuming constructive interference between $a_0(980) - f_0(980)$ mixing and electromagnetic decay. Destructive interference gives a value of $(4.93 \pm 1.77) \times 10^{-6}$ for this branching fraction.

² Assuming $a_0(980) - f_0(980)$ mixing and isospin breaking via γ^* and $K^* K$ loops.

NODE=M070S75
NODE=M070S75

NODE=M070S75;LINKAGE=A

NODE=M070S75;LINKAGE=AB

 $\Gamma(\phi f_2(1270))/\Gamma_{\text{total}}$ Γ_{119}/Γ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.45

90

FALVARD

88

DM2

 $J/\psi \rightarrow \text{hadrons}$

< 0.37

90

VANNUCCI

77

MRK1

 $e^+e^- \rightarrow \pi^+\pi^- K^+ K^-$

NODE=M070R39
NODE=M070R39

 $\Gamma(\phi f_1(1285))/\Gamma_{\text{total}}$ Γ_{120}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.6±0.5 OUR AVERAGE

3.4±1.8±1.5

1.1k

¹ ABLIKIM

15H

BES3

 $e^+e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

3.2±0.6±0.4

JOUSSET

90

DM2

 $J/\psi \rightarrow \phi 2(\pi^+ \pi^-)$

2.1±0.5±0.4

25

² JOUSSET

90

DM2

 $J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6±0.2±0.1

16

BECKER

87

MRK3

 $J/\psi \rightarrow \phi K \bar{K} \pi$

¹ ABLIKIM 15H reports $[\Gamma(J/\psi(1S) \rightarrow \phi f_1(1285))/\Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow \eta \pi^+ \pi^-)] = (1.20 \pm 0.6 \pm 0.14) \times 10^{-4}$ which we divide by our best value $B(f_1(1285) \rightarrow \eta \pi^+ \pi^-) = (35 \pm 15) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² We attribute to the $f_1(1285)$ the signal observed in the $\pi^+ \pi^- \eta$ invariant mass distribution at 1297 MeV.

NODE=M070S6
NODE=M070S6

OCCUR=2

NODE=M070S6;LINKAGE=A

NODE=M070S6;LINKAGE=Q

 $\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{121}/Γ VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

9.36±2.31±1.54

78

ABLIKIM

15P

BES3

 $J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S99
NODE=M070S99

 $\Gamma(\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi 3\pi^0)/\Gamma_{\text{total}}$ Γ_{122}/Γ VALUE (units 10^{-7})

EVTS

DOCUMENT ID

TECN

COMMENT

2.08±1.63±1.47

9

ABLIKIM

15P

BES3

 $J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S00
NODE=M070S00

 $\Gamma(\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{123}/Γ VALUE (units 10^{-5})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

2.01±0.58±0.82

172

¹ ABLIKIM

15H

BES3

 $e^+e^- \rightarrow J/\psi \rightarrow$ $\phi \eta \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 17

90

² FALVARD

88

DM2

 $J/\psi \rightarrow \text{hadrons}$

¹ With 3.6 σ significance.

² Includes unknown branching fraction $\eta(1405) \rightarrow \eta \pi \pi$.

NODE=M070S23
NODE=M070S23

NODE=M070S23;LINKAGE=B

NODE=M070S23;LINKAGE=A

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{124}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

8 ±4 OUR AVERAGE

Error includes scale factor of 2.7.

12.3±0.6±2.0

^{1,2} FALVARD

88

DM2

 $J/\psi \rightarrow \text{hadrons}$

4.8±1.8

46

¹ GIDAL

81

MRK2

 $J/\psi \rightarrow K^+ K^- K^+ K^-$

¹ Re-evaluated using $B(f'_2(1525) \rightarrow K \bar{K}) = 0.713$.

² Including interference with $f_0(1710)$.

NODE=M070R40
NODE=M070R40

NODE=M070R40;LINKAGE=B

NODE=M070R40;LINKAGE=C

 $\Gamma(\phi X(1835) \rightarrow \phi \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<2.1 × 10⁻⁷

90

¹ ABLIKIM

16K

BES3

 $J/\psi \rightarrow \rho \bar{\rho} K_S^0 K_L^0,$ $\rho \bar{\rho} K^+ K^-$

NODE=M070P00
NODE=M070P00

OCCUR=2

¹ Upper limit applies to any $\rho \bar{\rho}$ mass enhancement near threshold.

NODE=M070P00;LINKAGE=A

$\Gamma(\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{126} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-4}$	90	ABLIKIM	15H BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070B10
NODE=M070B10

 $\Gamma(\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{127} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.13 \times 10^{-5}$	90	ABLIKIM	15H BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \phi \eta \pi^+ \pi^-$

NODE=M070B11
NODE=M070B11

 $\Gamma(\phi K \bar{K}) / \Gamma_{\text{total}}$ Γ_{128} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
17.7 ± 1.6 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.				
16.6 ± 1.9 ± 1.2	163 ± 19	LEES	12F BABR	10.6 $e^+ e^- \rightarrow 2(K^+ K^-) \gamma$
21.4 ± 0.4 ± 2.2		ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-$
48 $^{+20}_{-16}$ ± 6	9.0 $^{+3.7}_{-3.0}$	1,2 HUANG	03 BELL	$B^+ \rightarrow (\phi K^+ K^-) K^+$
14.6 ± 0.8 ± 2.1		3 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
18 ± 8	14	FELDMAN	77 MRK1	$e^+ e^-$

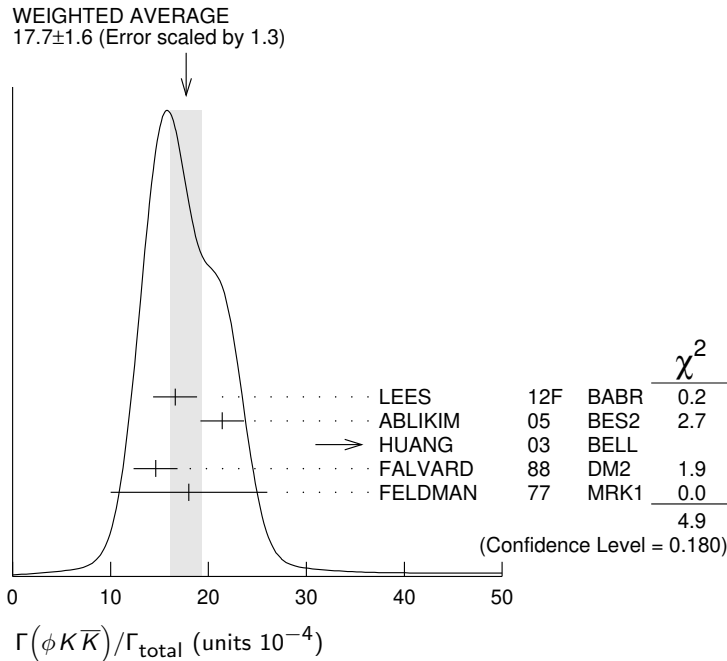
NODE=M070R36
NODE=M070R36

¹ We have multiplied $K^+ K^-$ measurement by 2 to obtain $K \bar{K}$.

² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³ Addition of $\phi K^+ K^-$ and $\phi K^0 \bar{K}^0$ branching ratios.

NODE=M070R36;LINKAGE=AA
NODE=M070R36;LINKAGE=CC
NODE=M070R36;LINKAGE=A


 $\Gamma(\phi f_0(1710) \rightarrow \phi K \bar{K}) / \Gamma_{\text{total}}$ Γ_{129} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6 ± 0.2 ± 0.6	1,2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S24
NODE=M070S24

¹ Including interference with $f_2'(1525)$.

² Includes unknown branching fraction $f_0(1710) \rightarrow K \bar{K}$.

NODE=M070S24;LINKAGE=D
NODE=M070S24;LINKAGE=E

 $\Gamma(\phi K^\pm K_S^0 \pi^\mp) / \Gamma_{\text{total}}$ Γ_{132} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.2 ± 0.8 OUR AVERAGE				
7.4 ± 0.6 ± 1.4	227 ± 19	ABLIKIM	08E BES2	$e^+ e^- \rightarrow J/\psi$
7.4 ± 0.9 ± 1.1		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
7 ± 0.6 ± 1.0	163 ± 15	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S3
NODE=M070S3

 $\Gamma(\phi K^*(892) \bar{K} + \text{c.c.}) / \Gamma_{\text{total}}$ Γ_{133} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.8 ± 2.3 OUR AVERAGE				
20.8 ± 2.7 ± 3.9	195 ± 25	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K_S^0 K^\pm \pi^\mp$
29.6 ± 3.7 ± 4.7	238 ± 30	ABLIKIM	08E BES2	$J/\psi \rightarrow \phi K^+ K^- \pi^0$
20.7 ± 2.4 ± 3.0		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$
20 ± 3 ± 3	155 ± 20	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S4
NODE=M070S4

OCCUR=2

$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{134}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

30 ± 5 OUR AVERAGE

31 ± 6

4600

AUGUSTIN

89

DM2

 $J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

29 ± 7

87

BURMESTER

77D

PLUT

 $e^+ e^-$ NODE=M070R49
NODE=M070R49 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{135}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

23 ± 3 ± 5

229

AUGUSTIN

89

DM2

 $e^+ e^-$ NODE=M070S28
NODE=M070S28 $\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$ Γ_{137}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

< 0.1 × 10⁻³

90

HENRARD

87

DM2

 $e^+ e^-$ NODE=M070S14
NODE=M070S14 $\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}}$ Γ_{138}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.58 ± 0.23 ± 0.40

332

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R70
NODE=M070R70 $\Gamma(\Delta(1232)^{++} \bar{\Delta}(1232)^{--})/\Gamma_{\text{total}}$ Γ_{139}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.10 ± 0.09 ± 0.28

233

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R66
NODE=M070R66 $\Gamma(\bar{\Sigma}(1385)^0 p K^-)/\Gamma_{\text{total}}$ Γ_{140}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.51 ± 0.26 ± 0.18

89

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R74
NODE=M070R74 $\Gamma(\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{141}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

< 0.82 × 10⁻⁵

90

ABLIKIM

13F

BES3

 $J/\psi \rightarrow p \bar{p} \pi^+ \pi^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.2 × 10⁻³

90

HENRARD

87

DM2

 $e^+ e^-$ NODE=M070S13
NODE=M070S13 $\Gamma(\Sigma(1385)^- \bar{\Sigma}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{142}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.30 ± 0.07 OUR AVERAGE[(0.31 ± 0.05) × 10⁻³ OUR 2023 AVERAGE]

0.30 ± 0.03 ± 0.08

74 ± 8

HENRARD

87

DM2

 $e^+ e^-$

0.29 ± 0.11 ± 0.10

26

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R68
NODE=M070R68

NEW

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{143}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

0.33 ± 0.08 OUR AVERAGE

0.34 ± 0.04 ± 0.08

77

HENRARD

87

DM2

 $e^+ e^-$

0.31 ± 0.11 ± 0.11

28

EATON

84

MRK2

 $e^+ e^-$ NODE=M070Q47
NODE=M070Q47 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{144}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.08 ± 0.06 OUR AVERAGE[(1.16 ± 0.05) × 10⁻³ OUR 2023 AVERAGE]

1.096 ± 0.012 ± 0.071

43k

ABLIKIM

16L

BES3

 $e^+ e^-$

1.23 ± 0.07 ± 0.30

0.8k

ABLIKIM

12P

BES2

 $e^+ e^-$

1.00 ± 0.04 ± 0.21

0.6k

HENRARD

87

DM2

 $e^+ e^-$

0.86 ± 0.18 ± 0.22

56

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R67
NODE=M070R67

NEW

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{145}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.25 ± 0.07 OUR AVERAGE

1.258 ± 0.014 ± 0.078

53k

ABLIKIM

16L

BES3

 $e^+ e^-$

1.50 ± 0.08 ± 0.38

1k

ABLIKIM

12P

BES2

 $e^+ e^-$

1.19 ± 0.04 ± 0.25

0.7k

HENRARD

87

DM2

 $e^+ e^-$

1.03 ± 0.24 ± 0.25

68

EATON

84

MRK2

 $e^+ e^-$ NODE=M070Q48
NODE=M070Q48

$\Gamma(\Sigma(1385)^0 \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$ Γ_{146}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.071 ± 0.009 ± 0.082	103k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow J/\psi \rightarrow$ hadrons

NODE=M070P17
NODE=M070P17

OCCUR=2

 $\Gamma(\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{147}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1 × 10⁻⁶	90	ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda \bar{\Lambda} \gamma$

NODE=M070S77
NODE=M070S77

 $\Gamma(\bar{\Lambda}(1520) \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.80 × 10⁻³	90	LU	19 BELL	$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M070P60
NODE=M070P60

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.17 ± 0.04 OUR AVERAGE				
1.165 ± 0.004 ± 0.043	135k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow J/\psi \rightarrow$ hadrons
1.20 ± 0.12 ± 0.21	206	ABLIKIM	08O BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S64
NODE=M070S64

 $\Gamma(\Xi(1530)^- \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{150}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.318 ± 0.008 OUR AVERAGE				
0.317 ± 0.002 ± 0.008	70k	ABLIKIM	20 BES3	$e^+ e^- \rightarrow J/\psi$
0.59 ± 0.09 ± 0.12	75	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S9
NODE=M070S9

 $\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{151}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.32 ± 0.12 ± 0.07	24 ± 9	HENRARD	87 DM2	$e^+ e^-$

NODE=M070S10
NODE=M070S10

 $\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{152}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S47
NODE=M070S47

 $\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{153}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S48
NODE=M070S48

 $\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{154}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S49
NODE=M070S49

 $\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$ Γ_{155}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S50
NODE=M070S50

 $\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$ Γ_{156}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 1.1 × 10⁻⁵	90	BAI	04G BES2	$e^+ e^-$

NODE=M070S51
NODE=M070S51

STABLE HADRONS

NODE=M070307

 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{157}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
5.44 ± 0.07 ± 0.33	23K	ANASHIN	22 KEDR	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
3.5 ± 0.8 ± 0.1	14k	¹ LEES	21 BABR	$10.6 e^+ e^- \rightarrow$ $2(\pi^+ \pi^-) 3\pi^0 \gamma$
4.73 ± 0.44	228k	² ABLIKIM	19Q BES3	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
3.25 ± 0.49	46055	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
3.17 ± 0.42	147	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow$ hadrons
3.64 ± 0.52	1500	BURMESTER	77D PLUT	$e^+ e^-$
4 ± 1	675	JEAN-MARIE	76 MRK1	$e^+ e^-$

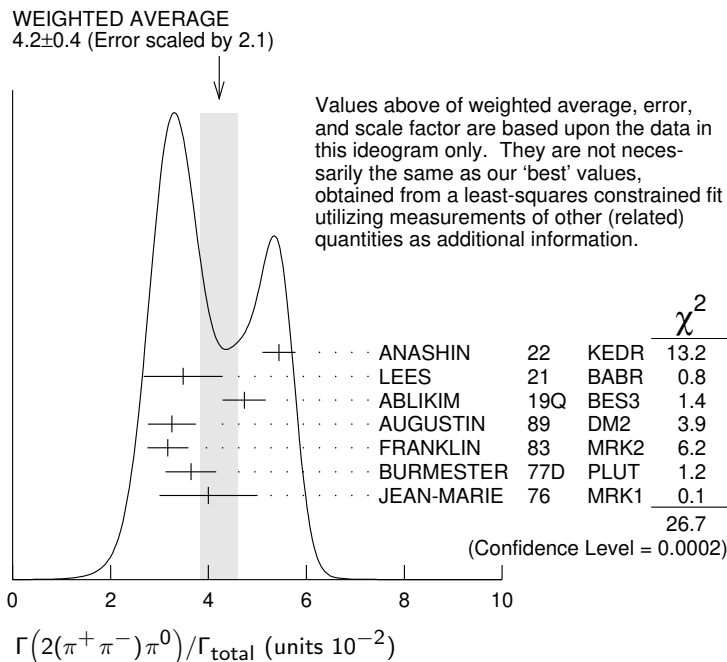
NODE=M070R9
NODE=M070R9

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0)] = (14.8 \pm 2.6 \pm 2.2) \times 10^{-3}$ keV which we divide by our best values $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) = (18.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

² From an energy scan of $e^+e^- \rightarrow J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)$, assuming PDG 16 values for $\Gamma(e^+e^-)$, $\Gamma(\mu^+\mu^-)$, and $\Gamma(\text{total})$, and for a phase difference between strong and electromagnetic amplitudes of $(84.9 \pm 3.6)^\circ$. An alternative solution is $(4.85 \pm 0.45)\%$ with a phase of $(-84.7 \pm 3.1)^\circ$.

NODE=M070R9;LINKAGE=B

NODE=M070R9;LINKAGE=A



$\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{158}/Γ
0.029±0.006 OUR AVERAGE					
0.028±0.009	11	FRANKLIN	83	MRK2 $e^+e^- \rightarrow \text{hadrons}$	
0.029±0.007	181	JEAN-MARIE	76	MRK1 e^+e^-	

NODE=M070R11
NODE=M070R11

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{163}/Γ
20.0 ±0.7 OUR AVERAGE					
Error includes scale factor of 2.0. See the ideogram below.					
[(21.0 ± 0.8) × 10 ⁻³ OUR 2023 AVERAGE Scale factor = 1.6]					
18.78±0.13±0.51	19.8k	¹ ANASHIN	23	KEDR $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$	
21.37±0.04 ^{+0.64} _{-0.62}	1.8M	² ABLIKIM	12H	BES3 $e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$	
23.0 ±2.0 ±0.4	256	³ AUBERT	07AU	BABR 10.6 $e^+e^- \rightarrow J/\psi \pi^+\pi^-\gamma$	
21.84±0.05±2.01	220k	^{4,5} BAI	04H	BES e^+e^-	
20.91±0.21±1.16		^{5,6} BAI	04H	BES e^+e^-	
15 ±2	168	FRANKLIN	83	MRK2 e^+e^-	

NODE=M070R7
NODE=M070R7

NEW

OCCUR=2

¹ By a simultaneous fit of the $\pi\pi$ invariant mass distribution over the decay modes $J/\psi \rightarrow \rho^0\pi^0$, $J/\psi \rightarrow \rho^+\pi^-$, $J/\psi \rightarrow \rho^-\pi^+$. In the fit only the intermediate states $\rho(770)\pi$ and $\rho(1450)\pi$ are considered.

² The quoted systematic error includes a contribution of 1.23% (added in quadrature) from the uncertainty on the number of J/ψ events.

³ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] = (18.6 \pm 1.2 \pm 1.1) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.808 \pm 0.014$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.

⁵ Mostly $\rho\pi$, see also $\rho\pi$ subsection.

⁶ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R7;LINKAGE=B

NODE=M070R7;LINKAGE=AB

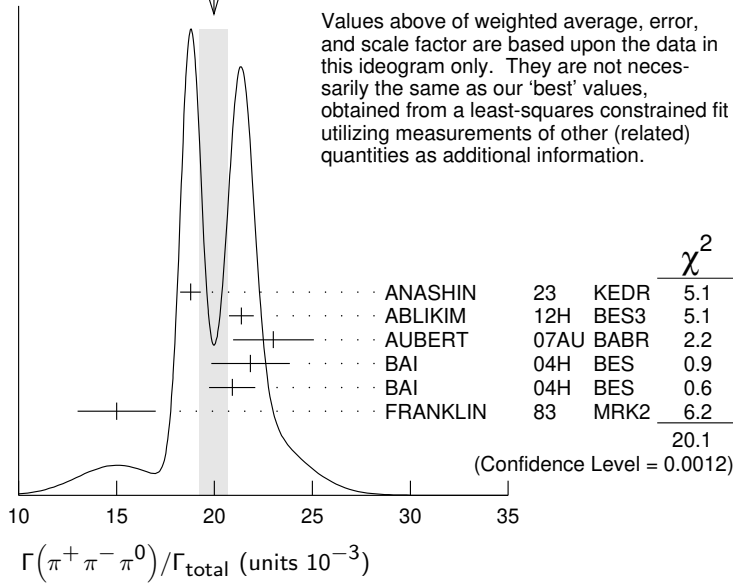
NODE=M070R7;LINKAGE=AU

NODE=M070R;LINKAGE=BA

NODE=M070R;LINKAGE=BU

NODE=M070R;LINKAGE=BI

WEIGHTED AVERAGE
20.0±0.7 (Error scaled by 2.0)



$\Gamma(\pi^+\pi^-\pi^0 K^+K^-)/\Gamma_{\text{total}}$ Γ_{165}/Γ

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.52±0.27 OUR AVERAGE		Error includes scale factor of 1.4.		
1.74±0.08±0.24	2616	ANASHIN	22	KEDR $J/\psi \rightarrow K^+K^-\pi^+\pi^-\pi^0$
1.2 ±0.3	309	VANNUCCI	77	MRK1 e^+e^-

NODE=M070R18
NODE=M070R18

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{166}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
1.47±0.14 OUR AVERAGE				
1.47±0.13±0.13	140	¹ METREVELI	12	$\psi(2S) \rightarrow 2(\pi^+\pi^-)$
1.58±0.20±0.15	84	BALTRUSAIT..85D	MRK3	e^+e^-
1.0 ±0.5	5	BRANDELIK	78B	DASP e^+e^-
1.6 ±1.6	1	VANNUCCI	77	MRK1 e^+e^-

NODE=M070R6
NODE=M070R6

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R6;LINKAGE=ME

$\Gamma(2\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{167}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
3.20±0.25 OUR AVERAGE		Error includes scale factor of 1.2.		
2.88±0.14±0.24	2654	ANASHIN	22	KEDR $J/\psi \rightarrow 2(\pi^+\pi^-)$
3.53±0.12±0.29	1107	¹ ABLIKIM	05H	BES2 $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi \pi^+\pi^-, J/\psi \rightarrow 2(\pi^+\pi^-)$
4.0 ±1.0	76	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R8
NODE=M070R8

¹ Computed using $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

NODE=M070R8;LINKAGE=AB

$\Gamma(3\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{168}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
40±20	32	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R10
NODE=M070R10

$\Gamma(4\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{170}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
90±30	13	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R12
NODE=M070R12

$\Gamma(2\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{171}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
2.29±0.28 OUR AVERAGE				
3.1 ±1.5 ±0.1	14k	¹ LEES	21	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$
2.26±0.08±0.27	4.8k	ABLIKIM	05C	BES2 $e^+e^- \rightarrow 2(\pi^+\pi^-)\eta$

NODE=M070S42
NODE=M070S42

¹ LEES 21 reports $[\Gamma(J/\psi(1S) \rightarrow 2(\pi^+\pi^-\eta))/\Gamma_{\text{total}}] \times [\Gamma(J/\psi(1S) \rightarrow e^+e^-)] \times [B(\eta \rightarrow 3\pi^0)] = (5.6 \pm 2.6 \pm 0.8) \times 10^{-3}$ keV which we divide by our best values $\Gamma(J/\psi(1S) \rightarrow e^+e^-) = 5.53 \pm 0.10$ keV, $B(\eta \rightarrow 3\pi^0) = (32.57 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070S42;LINKAGE=A

 $\Gamma(3(\pi^+\pi^-\eta))/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.24 \pm 0.96 \pm 1.11$	616	ABLIKIM	05C BES2	$e^+e^- \rightarrow 3(\pi^+\pi^-\eta)$

NODE=M070S43
NODE=M070S43 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{176}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.86 \pm 0.09 \pm 0.19$	1k	¹ METREVELI 12		$\psi(2S) \rightarrow \pi^+\pi^-K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.39 \pm 0.24 \pm 0.22$	107	² BALTRUSAIT..85D	MRK3	e^+e^-
2.2 ± 0.9	6	² BRANDELIK 79C	DASP	e^+e^-

NODE=M070R13
NODE=M070R13

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Interference with non-resonant K^+K^- production not taken into account.

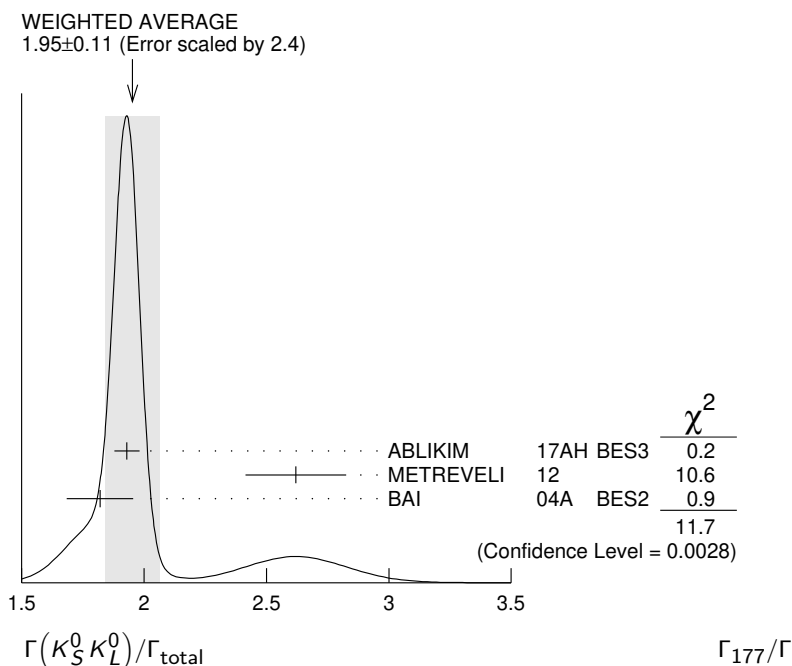
NODE=M070R13;LINKAGE=ME
NODE=M070R13;LINKAGE=BA $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{177}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.95 ± 0.11 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
$1.93 \pm 0.01 \pm 0.05$	110k	ABLIKIM	17AH BES3	$J/\psi \rightarrow K_S^0 K_L^0 \rightarrow \pi^+\pi^-X$
$2.62 \pm 0.15 \pm 0.14$	0.3k	¹ METREVELI 12		$\psi(2S) \rightarrow \pi^+\pi^-K_S^0 K_L^0$
$1.82 \pm 0.04 \pm 0.13$	2.1k	² BAI 04A	BES2	$J/\psi \rightarrow K_S^0 K_L^0 \rightarrow \pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.18 \pm 0.12 \pm 0.18$		JOUSSET 90	DM2	$J/\psi \rightarrow \text{hadrons}$
$1.01 \pm 0.16 \pm 0.09$	74	BALTRUSAIT..85D	MRK3	e^+e^-

NODE=M070R75
NODE=M070R75

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6868 \pm 0.0027$.

NODE=M070R75;LINKAGE=ME
NODE=M070R;LINKAGE=HZ $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{178}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-8}$	95	¹ ABLIKIM	17AH BES3	$J/\psi \rightarrow K_S^0 K_S^0 \rightarrow \pi^+\pi^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1 \times 10^{-6}$	95	¹ BAI 04D	BES	e^+e^-
$<5.2 \times 10^{-6}$	90	¹ BALTRUSAIT..85C	MRK3	e^+e^-

NODE=M070R14
NODE=M070R14

¹ Forbidden by CP.

NODE=M070R14;LINKAGE=C

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{179}/Γ VALUE (units 10^{-4}) EVTS**61 ± 10 OUR AVERAGE**

55.2 ± 12.0

25

DOCUMENT ID

TECN

COMMENT

FRANKLIN

83

MRK2

 $e^+e^- \rightarrow K^+K^-\pi^0$

78.0 ± 21.0

126

VANNUCCI

77

MRK1

 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$ NODE=M070R15
NODE=M070R15 $\Gamma(K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_{180}/Γ VALUE (units 10^{-3}) EVTS**2.88 ± 0.01 ± 0.12**

183k

DOCUMENT ID

TECN

COMMENT

ABLIKIM

19AQ

BES

 $J/\psi \rightarrow K^+K^-\pi^0$ NODE=M070P80
NODE=M070P80 $\Gamma(K^+K^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ $\Gamma_{180}/\Gamma_{163}$

VALUE (%) EVTS

12.0 ± 0.3 ± 0.9

23k

DOCUMENT ID

TECN

COMMENT

LEES

17C

BABR

 $J/\psi \rightarrow h^+h^-\pi^0$ NODE=M070P34
NODE=M070P34 $\Gamma(K_S^0 K^\pm \pi^\mp)/\Gamma(\pi^+\pi^-\pi^0)$ $\Gamma_{181}/\Gamma_{163}$

VALUE (%) EVTS

26.5 ± 0.5 ± 2.1

24k

DOCUMENT ID

TECN

COMMENT

LEES

17C

BABR

 $J/\psi \rightarrow h^0 h^+ h^-$ NODE=M070P35
NODE=M070P35 $\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{185}/Γ VALUE (units 10^{-3}) EVTS**7.04 ± 0.26 ± 0.92**

2671

DOCUMENT ID

TECN

COMMENT

ANASHIN

22

KEDR

 $J/\psi \rightarrow K^+K^-\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

7.2 ± 2.3

205

VANNUCCI

77

MRK1

 e^+e^- NODE=M070R16
NODE=M070R16 $\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{197}/Γ VALUE (units 10^{-4}) EVTS**31 ± 13**

30

DOCUMENT ID

TECN

COMMENT

VANNUCCI

77

MRK1

 e^+e^- NODE=M070R17
NODE=M070R17 $\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$ Γ_{199}/Γ VALUE (units 10^{-3}) EVTS

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $1.4^{+0.5}_{-0.4} \pm 0.2$ $11.0^{+4.3}_{-3.5}$ ¹ HUANG

03

BELL

 $B^+ \rightarrow 2(K^+K^-)K^+$

0.7 ± 0.3

VANNUCCI

77

MRK1

 e^+e^- ¹ Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

NODE=M070R19;LINKAGE=CC

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{207}/Γ VALUE (units 10^{-3}) EVTS**2.120 ± 0.029 OUR AVERAGE**

2.112 ± 0.004 ± 0.031

314k

DOCUMENT ID

TECN

COMMENT

ABLIKIM

12C

BES3

 e^+e^-

2.17 ± 0.16 ± 0.04

317

¹ WU

06

BELL

 $B^+ \rightarrow p\bar{p}K^+$

2.26 ± 0.01 ± 0.14

63316

BAI

04E

BES2

 $e^+e^- \rightarrow J/\psi$

1.97 ± 0.22

99

BALDINI

98

FENI

 e^+e^-

1.91 ± 0.04 ± 0.30

PALLIN

87

DM2

 e^+e^-

2.16 ± 0.07 ± 0.15

1420

EATON

84

MRK2

 e^+e^-

2.5 ± 0.4

133

BRANDELIK

79C

DASP

 e^+e^-

2.0 ± 0.5

BESCH

78

BONA

 e^+e^-

2.2 ± 0.2

331

² PERUZZI

78

MRK1

 e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.0 ± 0.3

48

ANTONELLI

93

SPEC

 e^+e^- ¹ WU 06 reports $[\Gamma(J/\psi(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)] = (2.21 \pm 0.13 \pm 0.10) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Assuming angular distribution $(1+\cos^2\theta)$.

NODE=M070R50;LINKAGE=WU

NODE=M070R50;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{208}/Γ VALUE (units 10^{-3}) EVTS**1.19 ± 0.08 OUR AVERAGE**

Error includes scale factor of 1.1.

1.33 ± 0.02 ± 0.11

11k

ABLIKIM

09B

BES2

 e^+e^-

1.13 ± 0.09 ± 0.09

685

EATON

84

MRK2

 e^+e^-

1.4 ± 0.4

BRANDELIK

79C

DASP

 e^+e^-

1.00 ± 0.15

109

PERUZZI

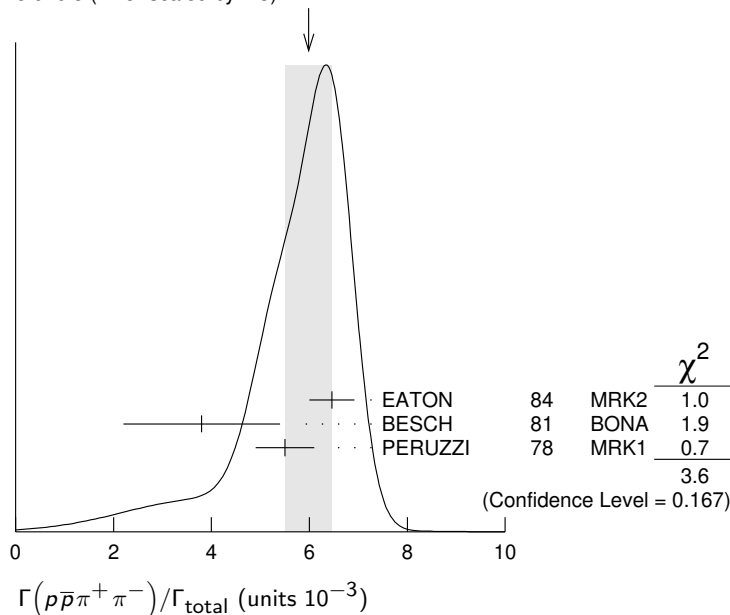
78

MRK1

 e^+e^- NODE=M070R52
NODE=M070R52

$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{209}/Γ NODE=M070R54
NODE=M070R54

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0 $\pm$ 0.5 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
6.46 $\pm$ 0.17 $\pm$ 0.43	1435	EATON	84	MRK2 e^+e^-
3.8 $\pm$ 1.6	48	BESCH	81	BONA e^+e^-
5.5 $\pm$ 0.6	533	PERUZZI	78	MRK1 e^+e^-

WEIGHTED AVERAGE
6.0 $\pm$ 0.5 (Error scaled by 1.3) $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{210}/Γ NODE=M070R55
NODE=M070R55
NODE=M070R55Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 $\pm$ 0.9 OUR AVERAGE		Error includes scale factor of 1.9.		
3.36 $\pm$ 0.65 $\pm$ 0.28	364	EATON	84	MRK2 e^+e^-
1.6 $\pm$ 0.6	39	PERUZZI	78	MRK1 e^+e^-

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{211}/Γ NODE=M070R56
NODE=M070R56

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 $\pm$ 0.12 OUR AVERAGE				
1.91 $\pm$ 0.02 $\pm$ 0.17	13k	¹ ABLIKIM	09	BES2 e^+e^-
2.03 $\pm$ 0.13 $\pm$ 0.15	826	EATON	84	MRK2 e^+e^-
2.5 $\pm$ 1.2		BRANDELIK	79C	DASP e^+e^-
2.3 $\pm$ 0.4	197	PERUZZI	78	MRK1 e^+e^-

¹ From the combination of $p\bar{p}\eta \rightarrow p\bar{p}\gamma\gamma$ and $p\bar{p}\eta \rightarrow p\bar{p}\pi^+\pi^-\pi^0$ channels.

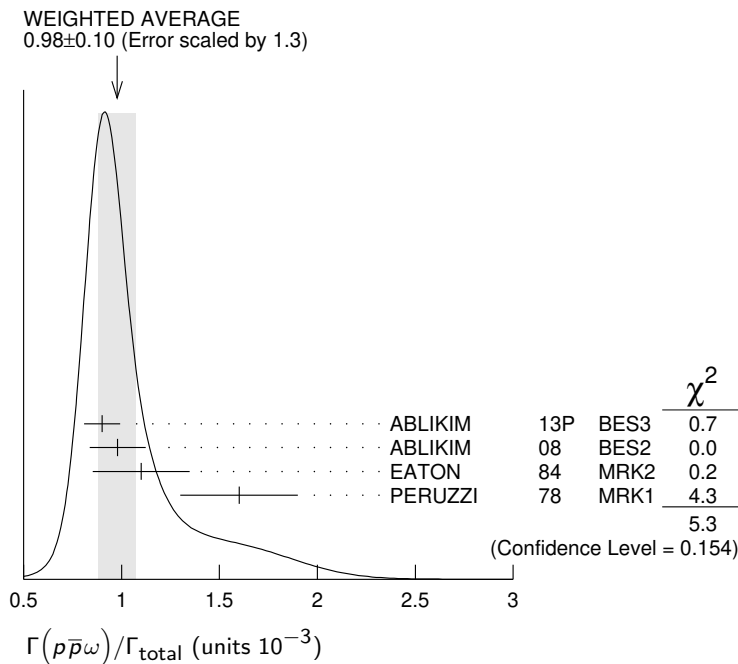
NODE=M070R56;LINKAGE=AB

 $\Gamma(p\bar{p}\rho)/\Gamma_{\text{total}}$ Γ_{212}/Γ NODE=M070R57
NODE=M070R57

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 0.31 \times 10^{-3}$	90	EATON	84	MRK2 $e^+e^- \rightarrow \text{hadrons}\gamma$

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{213}/Γ NODE=M070R58
NODE=M070R58

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 $\pm$ 0.10 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
0.90 $\pm$ 0.02 $\pm$ 0.09	2670	ABLIKIM	13P	BES3 e^+e^-
0.98 $\pm$ 0.03 $\pm$ 0.14	2449	ABLIKIM	08	BES2 e^+e^-
1.10 $\pm$ 0.17 $\pm$ 0.18	486	EATON	84	MRK2 e^+e^-
1.6 $\pm$ 0.3	77	PERUZZI	78	MRK1 e^+e^-



$\Gamma(p\bar{p}\eta(958))/\Gamma_{\text{total}}$

Γ_{214}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.129±0.014 OUR AVERAGE		Error includes scale factor of 2.0.		
0.126±0.002±0.007	16k	¹ ABLIKIM	19N BES3	e^+e^-
0.200±0.023±0.028	265 ± 31	² ABLIKIM	09 BES2	e^+e^-
0.68 ±0.23 ±0.17	19	EATON	84 MRK2	e^+e^-
1.8 ±0.6	19	PERUZZI	78 MRK1	e^+e^-

¹ From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\gamma$ channels.

² From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\gamma\rho^0$ channels.

NODE=M070R59
NODE=M070R59

NODE=M070R59;LINKAGE=A
NODE=M070R59;LINKAGE=AB

$\Gamma(p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta)/\Gamma_{\text{total}}$

Γ_{215}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.8±1.2±1.3	ABLIKIM	14N BES3	$e^+e^- \rightarrow J/\psi$

NODE=M070S94
NODE=M070S94

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$

Γ_{216}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.519±0.033 OUR AVERAGE				
0.523±0.006±0.033	14k	ABLIKIM	16K BES3	$J/\psi \rightarrow p\bar{p}K_S^0 K_L^0$, $p\bar{p}K^+ K^-$
0.45 ±0.13 ±0.07		FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S22
NODE=M070S22

$\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$

Γ_{217}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.12±0.09 OUR AVERAGE				
2.36±0.02±0.21	59k	ABLIKIM	06K BES2	$J/\psi \rightarrow p\pi^-\bar{n}$
2.47±0.02±0.24	55k	ABLIKIM	06K BES2	$J/\psi \rightarrow \bar{p}\pi^+n$
2.02±0.07±0.16	1288	EATON	84 MRK2	$e^+e^- \rightarrow p\pi^-$
1.93±0.07±0.16	1191	EATON	84 MRK2	$e^+e^- \rightarrow \bar{p}\pi^+$
1.7 ±0.7	32	BESCH	81 BONA	$e^+e^- \rightarrow p\pi^-$
1.6 ±1.2	5	BESCH	81 BONA	$e^+e^- \rightarrow \bar{p}\pi^+$
2.16±0.29	194	PERUZZI	78 MRK1	$e^+e^- \rightarrow p\pi^-$
2.04±0.27	204	PERUZZI	78 MRK1	$e^+e^- \rightarrow \bar{p}\pi^+$

NODE=M070R53
NODE=M070R53

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

$\Gamma(n\bar{n})/\Gamma_{\text{total}}$

Γ_{218}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.09±0.16 OUR AVERAGE				
2.07±0.01±0.17	36k	ABLIKIM	12C BES3	e^+e^-
2.31±0.49	79	BALDINI	98 FENI	e^+e^-
1.8 ±0.9		BESCH	78 BONA	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.90±0.55	40	ANTONELLI	93 SPEC	e^+e^-

NODE=M070R64
NODE=M070R64

$\Gamma(n\bar{n}\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
3.8 ± 3.6	5	BESCH	81	BONA e^+e^-

 Γ_{219}/Γ

NODE=M070R65
NODE=M070R65

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.88 ± 0.08 OUR AVERAGE		Error includes scale factor of 2.6. See the ideogram below. [(1.89 ± 0.09) $\times 10^{-3}$ OUR 2023 AVERAGE Scale factor = 2.8]		

 Γ_{223}/Γ

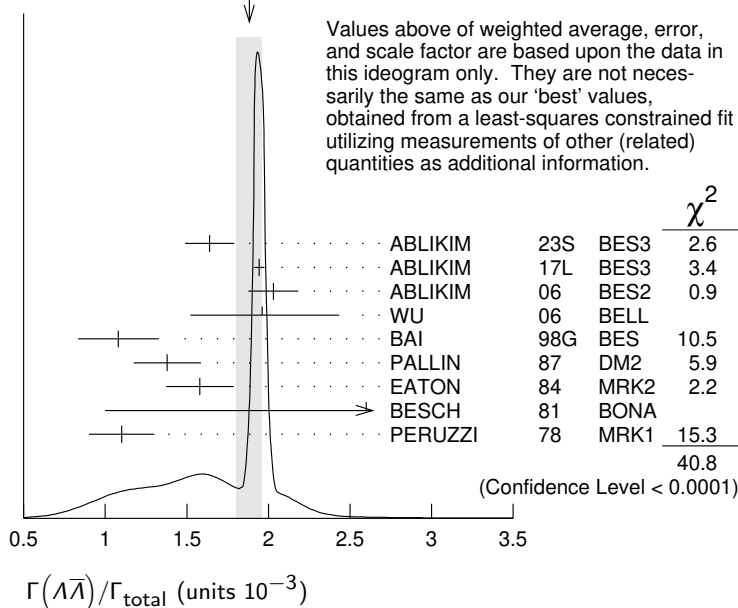
NODE=M070R60
NODE=M070R60
NEW

$1.64 \pm 0.12 \pm 0.09$		ABLIKIM	23S	BES3	$e^+e^- \rightarrow \gamma\Lambda\bar{\Lambda}$
$1.943 \pm 0.003 \pm 0.033$	441k	ABLIKIM	17L	BES3	e^+e^-
$2.03 \pm 0.03 \pm 0.15$	8887	ABLIKIM	06	BES2	$J/\psi \rightarrow \Lambda\bar{\Lambda}$
$1.96^{+0.47}_{-0.44} \pm 0.04$	46	¹ WU	06	BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
$1.08 \pm 0.06 \pm 0.24$	631	BAI	98G	BES	e^+e^-
$1.38 \pm 0.05 \pm 0.20$	1847	PALLIN	87	DM2	e^+e^-
$1.58 \pm 0.08 \pm 0.19$	365	EATON	84	MRK2	e^+e^-
2.6 ± 1.6	5	BESCH	81	BONA	e^+e^-
1.1 ± 0.2	196	PERUZZI	78	MRK1	e^+e^-

¹WU 06 reports [$\Gamma(J/\psi(1S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}$] $\times$ [$B(B^+ \rightarrow J/\psi(1S)K^+)$] = ($2.00^{+0.34}_{-0.29} \pm 0.34$) $\times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S)K^+)$ = (1.020 ± 0.019) $\times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R60;LINKAGE=WU

WEIGHTED AVERAGE
 1.88 ± 0.08 (Error scaled by 2.6)

 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$3.78 \pm 0.27 \pm 0.30$		323	¹ ABLIKIM	13F	BES3 $J/\psi \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$

 Γ_{224}/Γ

NODE=M070S11
NODE=M070S11

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 6.4	90	² ABLIKIM	07H	BES2	$e^+e^- \rightarrow \psi(2S)$
23 ± 7 ± 8	11	BAI	98G	BES	e^+e^-
22 ± 5 ± 5	19	HENRARD	87	DM2	e^+e^-

¹Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.

²Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.

NODE=M070S11;LINKAGE=AL
NODE=M070S11;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.30 \pm 0.13 \pm 0.99$	2.4k	ABLIKIM	12P	BES2 J/ψ

 Γ_{225}/Γ

NODE=M070S78
NODE=M070S78

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{226}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
16.2±1.7 OUR AVERAGE				
15.7±0.80±1.54	454	¹ ABLIKIM	13F BES3	$J/\psi \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
26.2±6.0 ±4.4	44	² ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.NODE=M070R07
NODE=M070R07NODE=M070R07;LINKAGE=AL
NODE=M070R07;LINKAGE=AB $\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{227}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.26 ±0.05 OUR AVERAGE				Error includes scale factor of 1.2. $[(0.83 \pm 0.07) \times 10^{-3}]$
		OUR 2023 AVERAGE Scale factor = 1.2]		
1.244±0.002±0.045	2.6M	ABLIKIM	23BU BES3	e^+e^-
1.52 ±0.08 ±0.16	589	¹ ABLIKIM	07H BES2	e^+e^-
1.11 ±0.06 ±0.20	342 ± 18	HENRARD	87 DM2	e^+e^-
1.38 ±0.21 ±0.35	118	EATON	84 MRK2	e^+e^-

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.NODE=M070R71
NODE=M070R71

NEW

OCCUR=3
OCCUR=2
OCCUR=2

NODE=M070R71;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{228}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.21 ±0.07 OUR AVERAGE				Error includes scale factor of 1.8.
1.221±0.002±0.038	2.7M	ABLIKIM	23BU BES3	e^+e^-
0.90 ±0.06 ±0.16	225	HENRARD	87 DM2	e^+e^-
1.53 ±0.17 ±0.38	135	EATON	84 MRK2	e^+e^-

NODE=M070Q46
NODE=M070Q46 $\Gamma(pK^-\bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{229}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.86±0.11 OUR AVERAGE				
0.84 ^{+0.17} _{-0.15} ±0.02	45	¹ LU	19 BELL	$B^+ \rightarrow \bar{p}\Lambda K^+ K^+$
0.89±0.07±0.14	307	EATON	84 MRK2	e^+e^-

¹ LU 19 reports $(8.32^{+1.63}_{-1.45} \pm 0.49) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow pK^-\bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S)K^+)]$ assuming $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.026 \pm 0.031) \times 10^{-3}$, which we rescale to our best value $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.020 \pm 0.019) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R72
NODE=M070R72

NODE=M070R72;LINKAGE=A

 $\Gamma(pK^-\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{230}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.29±0.06±0.05	90	EATON	84 MRK2	e^+e^-

NODE=M070R73
NODE=M070R73 $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{231}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
6.46±0.20±1.07	1058	¹ ABLIKIM	08C BES2	$e^+e^- \rightarrow J/\psi$

¹ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.NODE=M070S56
NODE=M070S56

NODE=M070S56;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Sigma} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{232}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.83±0.23 OUR AVERAGE					
2.74±0.24±0.22	234 ± 21	¹ ABLIKIM	12B BES3	$J/\psi \rightarrow \Lambda\bar{\Sigma}^0$	
2.92±0.22±0.24	308 ± 24	² ABLIKIM	12B BES3	$J/\psi \rightarrow \bar{\Lambda}\Sigma^0$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18		² HENRARD	87 DM2	$J/\psi \rightarrow \bar{\Lambda}\Sigma^0$	
<15	90	PERUZZI	78 MRK1	$e^+e^- \rightarrow \Lambda X$	

¹ ABLIKIM 12B quotes $B(J/\psi \rightarrow \Lambda\bar{\Sigma}^0)$ which we multiply by 2.² ABLIKIM 12B and HENRARD 87 quote results for $B(J/\psi \rightarrow \bar{\Lambda}\Sigma^0)$ which we multiply by 2.NODE=M070R61
NODE=M070R61

OCCUR=2

NODE=M070R61;LINKAGE=AB
NODE=M070R61;LINKAGE=AC $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{233}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.07 ±0.04 OUR AVERAGE				
1.061±0.004±0.036	87k	ABLIKIM	21AT BES3	$J/\psi \rightarrow p\pi^0\bar{p}\pi^0$
1.50 ±0.10 ±0.22	399	ABLIKIM	08O BES2	$e^+e^- \rightarrow J/\psi$

NODE=M070S09
NODE=M070S09

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{234}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.172 ± 0.032 OUR AVERAGE		Error includes scale factor of 1.4.		
$1.164 \pm 0.004 \pm 0.023$	111k	ABLIKIM	17L BES3	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
$1.33 \pm 0.04 \pm 0.11$	1.7k	ABLIKIM	06 BES2	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
$1.06 \pm 0.04 \pm 0.23$	884	PALLIN	87 DM2	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
$1.58 \pm 0.16 \pm 0.25$	90	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.3 ± 0.4	52	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.4 ± 2.6	3	BESCH	81 BONA	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

NODE=M070R63
 NODE=M070R63

 $\Gamma(\Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}$ Γ_{235}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.34 \pm 0.21 \pm 0.37$	1821	ABLIKIM	22AY BES3	$J/\psi \rightarrow \Sigma^+ \bar{\Sigma}^- \eta$

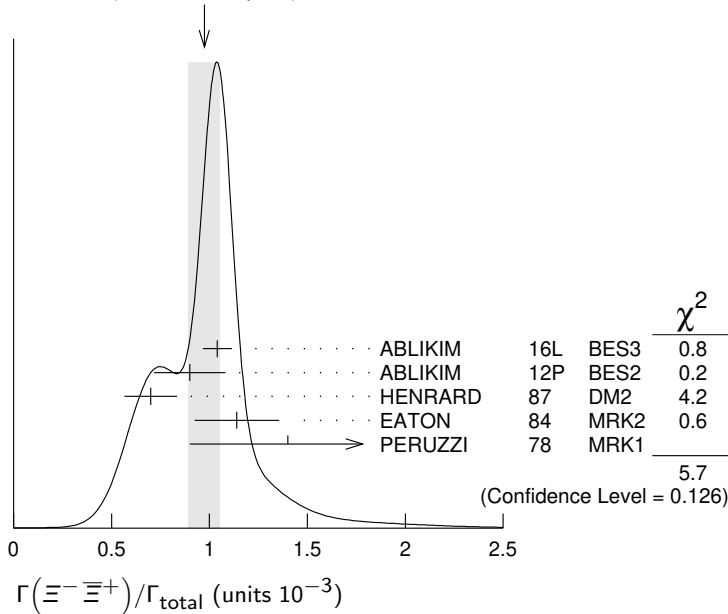
NODE=M070Q45
 NODE=M070Q45

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{236}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.08 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
$1.040 \pm 0.006 \pm 0.074$	43k	ABLIKIM	16L BES3	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
$0.90 \pm 0.03 \pm 0.18$	961	ABLIKIM	12P BES2	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
$0.70 \pm 0.06 \pm 0.12$	132	HENRARD	87 DM2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
$1.14 \pm 0.08 \pm 0.20$	194	EATON	84 MRK2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.4 ± 0.5	51	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$

NODE=M070R62
 NODE=M070R62

WEIGHTED AVERAGE
 0.97 ± 0.08 (Error scaled by 1.4)



RADIATIVE DECAYS

 $\Gamma(\gamma \eta_c(1S))/\Gamma_{\text{total}}$ Γ_{237}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.41 ± 0.14 OUR FIT	Error includes scale factor of 1.3.		
1.7 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.5.		
$2.00 \pm 0.31 \pm 0.02$	¹ MITCHELL	09 CLEO	$e^+ e^- \rightarrow \gamma X$
1.27 ± 0.36	GAISER	86 CBAL	$J/\psi \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.40 ± 0.33	² ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma \eta_c$

NODE=M070310

NODE=M070R85
 NODE=M070R85

¹ MITCHELL 09 reports $(1.98 \pm 0.09 \pm 0.30) \times 10^{-2}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (35.04 \pm 0.07 \pm 0.77) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Statistical uncertainty only.

NODE=M070R85;LINKAGE=MI

NODE=M070R85;LINKAGE=A

$\Gamma(3\gamma)/\Gamma_{\text{total}}$
 Γ_{240}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
11.6±2.2 OUR AVERAGE					
11.3±1.8±2.0		113 ± 18	ABLIKIM	13I BES3	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$
12 ±3 ±2		24.2 ^{+7.2} _{-6.0}	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<55	90	PARTRIDGE	80	CBAL	e^+e^-

NODE=M070R81
NODE=M070R81

 $\Gamma(4\gamma)/\Gamma_{\text{total}}$
 Γ_{241}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9 × 10⁻⁶	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S06
NODE=M070S06

 $\Gamma(5\gamma)/\Gamma_{\text{total}}$
 Γ_{242}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15 × 10⁻⁶	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S07
NODE=M070S07

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$
 Γ_{243}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.39±0.08 OUR AVERAGE				

[(3.56 ± 0.17) × 10⁻⁵ OUR 2023 AVERAGE]

3.34±0.02±0.09	176k	ABLIKIM	23BD BES3	$J/\psi \rightarrow \pi^0\gamma$
3.59±0.20±0.04	1.6k	¹ ABLIKIM	18O BES3	$\psi(2S) \rightarrow \pi^+\pi^- \gamma\gamma\gamma$
3.63±0.36±0.13		PEDLAR	09 CLE3	$J/\psi \rightarrow \pi^0\gamma$
3.13 ^{+0.65} _{-0.47}	586	ABLIKIM	06E BES2	$J/\psi \rightarrow \pi^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.6 ±1.1 ±0.7		BLOOM	83	CBAL	e^+e^-

7.3 ±4.7	10	BRANDELIK	79C	DASP	e^+e^-

¹ ABLIKIM 18O reports [$\Gamma(J/\psi(1S) \rightarrow \gamma\pi^0)/\Gamma_{\text{total}}$] × [B($\pi^0 \rightarrow 2\gamma$)] = (3.57 ± 0.12 ± 0.16) × 10⁻⁵ from a measurement of [$\Gamma(J/\psi(1S) \rightarrow \gamma\pi^0)/\Gamma_{\text{total}}$] × [B($\pi^0 \rightarrow 2\gamma$)] × [B($\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-$)] assuming B($\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-$) = (34.49 ± 0.30) × 10⁻², which we rescale to our best values B($\pi^0 \rightarrow 2\gamma$) = (98.823 ± 0.034) × 10⁻², B($\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-$) = (34.69 ± 0.34) × 10⁻². Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R82
NODE=M070R82
NEW

NODE=M070R82;LINKAGE=A

 $\Gamma(\gamma\pi^0\pi^0)/\Gamma_{\text{total}}$
 Γ_{244}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.15±0.05	¹ ABLIKIM	15AE BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

¹ The uncertainty is systematic as statistical is negligible.

NODE=M070B00
NODE=M070B00

NODE=M070B00;LINKAGE=A

 $\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$
 Γ_{245}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.8 ±0.5 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.		

4.32±0.14±0.73	¹ BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$
2.08±0.13±0.35	² BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$
3.05±0.08±0.45	² BALTRUSAIT..	86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
4.85±0.45±1.20	³ BURKE	82	MRK2	e^+e^-

¹ 4 π mass less than 3.0 GeV.

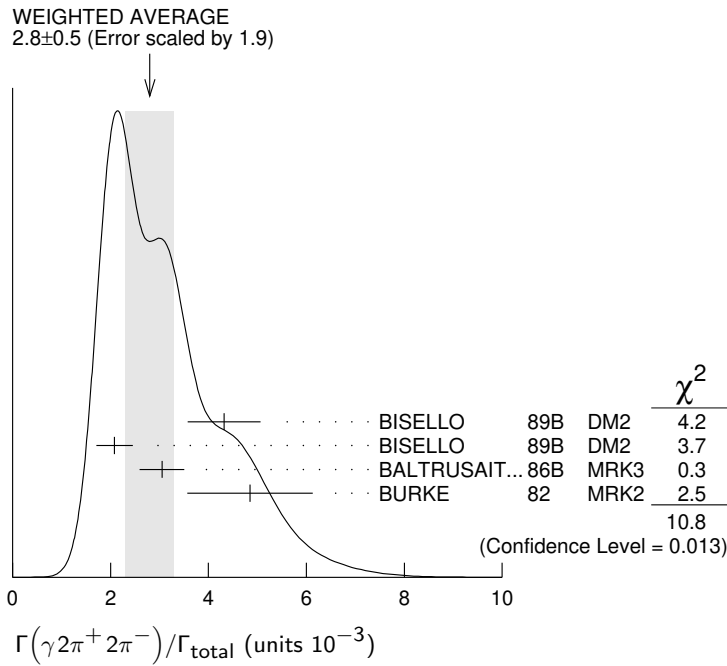
² 4 π mass less than 2.0 GeV.

³ 4 π mass less than 2.5 GeV.

NODE=M070R95
NODE=M070R95

OCCUR=2

NODE=M070R95;LINKAGE=A
NODE=M070R95;LINKAGE=B
NODE=M070R95;LINKAGE=M



$\Gamma(\gamma f_2(1270) f_2(1270))/\Gamma_{\text{total}}$ Γ_{246}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.5±0.7±1.6	646 ± 45	ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S45
NODE=M070S45

$\Gamma(\gamma f_2(1270) f_2(1270) (\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{247}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.2±0.8±1.7	¹ ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M070S46
NODE=M070S46

¹ Subtracting contribution from intermediate $\eta_c(1S)$ decays.

NODE=M070S46;LINKAGE=AB

$\Gamma(\gamma \pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{248}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.3±0.2±3.1	¹ BALTRUSAIT...86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$

NODE=M070R99
NODE=M070R99

¹ 4π mass less than 2.0 GeV.

NODE=M070R99;LINKAGE=M

$\Gamma(\gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{249}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.1±0.4	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P73
NODE=M070P73

$\Gamma(\gamma(K\bar{K}\pi)[J^{PC}=0^{-+}])/ \Gamma_{\text{total}}$ Γ_{250}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.7 ±0.4 OUR AVERAGE	Error includes scale factor of 2.1.		
0.58±0.03±0.20	¹ BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
2.1 ±0.1 ±0.7	² BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

NODE=M070S38
NODE=M070S38

¹ For a broad structure around 1800 MeV.

² For a broad structure around 2040 MeV.

OCCUR=2

NODE=M070S38;LINKAGE=BD
NODE=M070S38;LINKAGE=BE

$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{251}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.1±0.6	1516	BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B05
NODE=M070B05

$\Gamma(\gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{252}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0±0.3±1.3	320	¹ BAI	00B BES	$J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$

NODE=M070B07
NODE=M070B07

¹ Summed over all charges.

NODE=M070R;LINKAGE=B7

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{253}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

1.090 $\pm$ 0.013 OUR AVERAGE[(1.085 $\pm$ 0.018) $\times 10^{-3}$ OUR 2023 AVERAGE]

1.096 $\pm$ 0.001 $\pm$ 0.019	2.2M	ABLIKIM	23BD BES3	$J/\psi \rightarrow \eta\gamma$
1.067 $\pm$ 0.005 $\pm$ 0.023	87.9k	ABLIKIM	21AMBES3	$e^+e^- \rightarrow J/\psi$
1.12 $\pm$ 0.05 $\pm$ 0.01	18.6k	¹ ABLIKIM	18O BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$
1.101 $\pm$ 0.029 $\pm$ 0.022		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta\gamma$
1.123 $\pm$ 0.089	11k	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.88 $\pm$ 0.08 $\pm$ 0.11 BLOOM 83 CBAL e^+e^- 0.82 $\pm$ 0.10 BRANDELIK 79C DASP e^+e^- 1.3 $\pm$ 0.4 21 BARTEL 77 CNTR e^+e^-

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\eta)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = (4.42 \pm 0.04 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma\eta)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.49 \pm 0.30) \times 10^{-2}$, which we rescale to our best values $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R83

NODE=M070R83

NEW

NODE=M070R83;LINKAGE=A

 $\Gamma(\gamma\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{254}/Γ VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

21.4 $\pm$ 1.8 $\pm$ 2.5

596

ABLIKIM

16P

BES3

 $J/\psi \rightarrow 5\gamma$ $\Gamma(\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{258}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<2.5 $\times 10^{-6}$

95

ABLIKIM

16P

BES3

 $J/\psi \rightarrow 5\gamma$

NODE=M070P01

NODE=M070P01

NODE=M070P02

NODE=M070P02

 $\Gamma(\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{259}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<6.6 $\times 10^{-6}$

95

ABLIKIM

16P

BES3

 $J/\psi \rightarrow 5\gamma$

NODE=M070P03

NODE=M070P03

 $\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$ Γ_{260}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

6.1 $\pm$ 1.0 OUR AVERAGE5.85 $\pm$ 0.3 $\pm$ 1.05¹ EDWARDS

83B

CBAL

 $J/\psi \rightarrow \eta\pi^+\pi^-$ 7.8 $\pm$ 1.2 $\pm$ 2.4¹ EDWARDS

83B

CBAL

 $J/\psi \rightarrow \eta 2\pi^0$ ¹ Broad enhancement at 1700 MeV.

NODE=M070R96

NODE=M070R96

OCCUR=2

NODE=M070R96;LINKAGE=M

 $\Gamma(\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{261}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

6.2 $\pm$ 2.2 $\pm$ 0.9

BAI

99

BES

 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M070S37

NODE=M070S37

 $\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{262}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

5.28 $\pm$ 0.06 OUR AVERAGE

Error includes scale factor of 1.3. See the ideogram below.

[(5.25 $\pm$ 0.07) $\times 10^{-3}$ OUR 2023 AVERAGE Scale factor = 1.3]

5.40 $\pm$ 0.01 $\pm$ 0.11	638k	ABLIKIM	23BD BES3	$J/\psi \rightarrow \gamma\eta'$
5.27 $\pm$ 0.03 $\pm$ 0.05	36k	ABLIKIM	19T BES	$J/\psi \rightarrow \gamma\eta'$
5.43 $\pm$ 0.23 $\pm$ 0.09	5.0k	¹ ABLIKIM	18O BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$
4.77 $\pm$ 0.22 $\pm$ 0.06		² ABLIKIM	11 BES3	$J/\psi \rightarrow \eta'\gamma$
5.24 $\pm$ 0.12 $\pm$ 0.11		PEDLAR	09 CLE3	$J/\psi \rightarrow \eta'\gamma$
5.55 $\pm$ 0.44	35k	ABLIKIM	06E BES2	$J/\psi \rightarrow \eta'\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.50 $\pm$ 0.14 $\pm$ 0.53 BOLTON 92B MRK3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \gamma\gamma$ 4.30 $\pm$ 0.31 $\pm$ 0.71 BOLTON 92B MRK3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta, \eta \rightarrow \pi^+\pi^-\pi^0$ 4.04 $\pm$ 0.16 $\pm$ 0.85 622 AUGUSTIN 90 DM2 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$ 4.39 $\pm$ 0.09 $\pm$ 0.66 2420 AUGUSTIN 90 DM2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$ 4.1 $\pm$ 0.3 $\pm$ 0.6 BLOOM 83 CBAL $e^+e^- \rightarrow 3\gamma + \text{hadrons}$ 2.9 $\pm$ 1.1 6 BRANDELIK 79C DASP $e^+e^- \rightarrow 3\gamma$ 2.4 $\pm$ 0.7 57 BARTEL 76 CNTR $e^+e^- \rightarrow 2\gamma\rho$

NODE=M070R84

NODE=M070R84

NEW

OCCUR=2

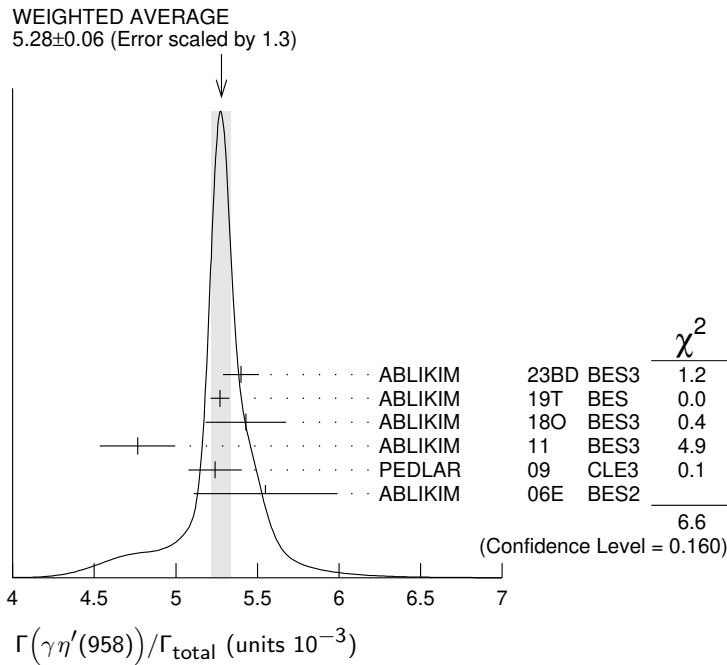
OCCUR=2

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958))/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \gamma \gamma)] = (1.26 \pm 0.02 \pm 0.05) \times 10^{-4}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958))/\Gamma_{\text{total}}] \times [B(\eta'(958) \rightarrow \gamma \gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.49 \pm 0.30) \times 10^{-2}$, which we rescale to our best values $B(\eta'(958) \rightarrow \gamma \gamma) = (2.307 \pm 0.033) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84;LINKAGE=A

² ABLIKIM 11 reports $(4.84 \pm 0.03 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \eta'(958))/\Gamma_{\text{total}}] / [B(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)]$ assuming $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (43.2 \pm 0.7) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.31 \pm 0.20) \times 10^{-2}$, which we rescale to our best values $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (42.5 \pm 0.5) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R84;LINKAGE=AB



$\Gamma(\gamma f_0(500) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{255}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10.5±2.0	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P95
NODE=M070P95

$\Gamma(\gamma f_0(500) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{256}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5±5	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P97
NODE=M070P97

$\Gamma(\gamma f_0(500) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{257}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4±3	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P98
NODE=M070P98

$\Gamma(\gamma f_0(980) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{263}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.3±0.2	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P90
NODE=M070P90

$\Gamma(\gamma f_0(980) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{264}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.8±0.3	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P91
NODE=M070P91

$\Gamma(\gamma\rho\rho)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) CL%**4.5 $\pm$ 0.8 OUR AVERAGE**4.7 $\pm$ 0.3 $\pm$ 0.93.75 $\pm$ 1.05 $\pm$ 1.20

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.09

90

³ BISELLO 89B $J/\psi \rightarrow 4\pi\gamma$ ¹ 4π mass less than 2.0 GeV.² 4π mass less than 2.0 GeV. We have multiplied $2\rho^0$ measurement by 3 to obtain 2ρ .³ 4π mass in the range 2.0–25 GeV. Γ_{265}/Γ NODE=M070R94
NODE=M070R94 $\Gamma(\gamma\rho\omega)/\Gamma_{\text{total}}$

VALUE CL%

<5.4 $\times 10^{-4}$

90

DOCUMENT ID TECN COMMENT

ABLIKIM 08A BES2 $e^+e^- \rightarrow J/\psi$ Γ_{266}/Γ NODE=M070R05
NODE=M070R05 $\Gamma(\gamma\rho\phi)/\Gamma_{\text{total}}$

VALUE CL%

<8.8 $\times 10^{-5}$

90

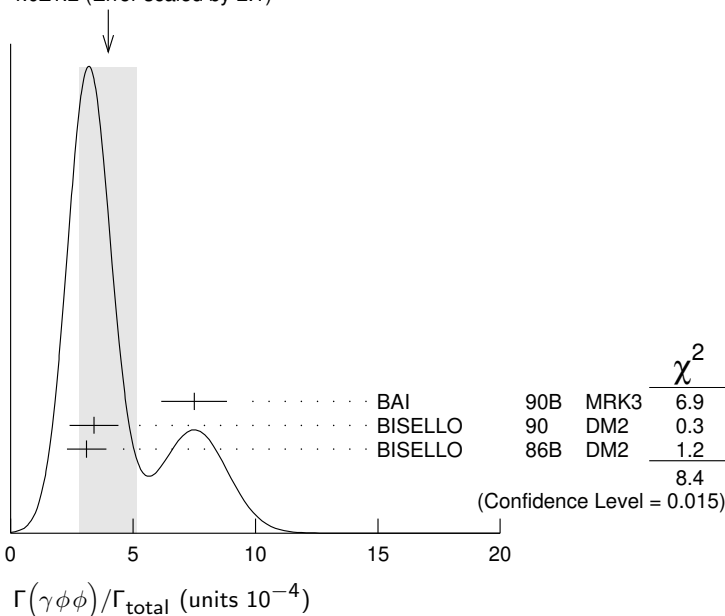
DOCUMENT ID TECN COMMENT

ABLIKIM 08A BES2 $e^+e^- \rightarrow J/\psi$ Γ_{267}/Γ NODE=M070R06
NODE=M070R06 $\Gamma(\gamma\omega\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.61 $\pm$ 0.33 OUR AVERAGE**6.0 $\pm$ 4.8 $\pm$ 1.81.41 $\pm$ 0.2 $\pm$ 0.42 120 $\pm$ 171.76 $\pm$ 0.09 $\pm$ 0.45

DOCUMENT ID TECN COMMENT

ABLIKIM 08A BES2 $J/\psi \rightarrow \gamma\omega\pi^+\pi^-$ BISELLO 87 SPEC e^+e^- , hadrons γ BALTRUSAIT..85C MRK3 $e^+e^- \rightarrow$ hadrons γ Γ_{268}/Γ NODE=M070R97
NODE=M070R97 $\Gamma(\gamma\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**4.0 $\pm$ 1.2 OUR AVERAGE** Error includes scale factor of 2.1. See the ideogram below.7.5 $\pm$ 0.6 $\pm$ 1.2

168

BAI 90B MRK3 $J/\psi \rightarrow \gamma 4K$ 3.4 $\pm$ 0.8 $\pm$ 0.633 $\pm$ 7¹ BISELLO 90 DM2 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ 3.1 $\pm$ 0.7 $\pm$ 0.4¹ BISELLO 86B DM2 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$ ¹ $\phi\phi$ mass less than 2.9 GeV, η_c excluded. Γ_{269}/Γ NODE=M070R98
NODE=M070R98WEIGHTED AVERAGE
4.0 $\pm$ 1.2 (Error scaled by 2.1)

NODE=M070R98;LINKAGE=C

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**2.8 $\pm$ 0.6 OUR AVERAGE** Error includes scale factor of 1.6. See the ideogram below.1.66 $\pm$ 0.1 $\pm$ 0.58^{1,2} BAI 00D BES $J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$ 3.8 $\pm$ 0.3 $\pm$ 0.6³ AUGUSTIN 90 DM2 $J/\psi \rightarrow \gamma K \bar{K} \pi$ 4.0 $\pm$ 0.7 $\pm$ 1.0³ EDWARDS 82E CBAL $J/\psi \rightarrow K^+ K^- \pi^0 \gamma$ 4.3 $\pm$ 1.7^{3,4} SCHARRE 80 MRK2 e^+e^- Γ_{270}/Γ NODE=M070R89
NODE=M070R89

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.78 \pm 0.21 \pm 0.33$	3,5,6 AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$0.83 \pm 0.13 \pm 0.18$	3,7,8 AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$
$0.66^{+0.17+0.24}_{-0.16-0.15}$	3,6,9 BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
$1.03^{+0.21+0.26}_{-0.18-0.19}$	3,8,10 BAI	90C	MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=2

OCCUR=2

NODE=M070R89;LINKAGE=BD

NODE=M070R89;LINKAGE=BE

NODE=M070R89;LINKAGE=B

NODE=M070R89;LINKAGE=C

NODE=M070R89;LINKAGE=H

NODE=M070R89;LINKAGE=K9

NODE=M070R89;LINKAGE=J

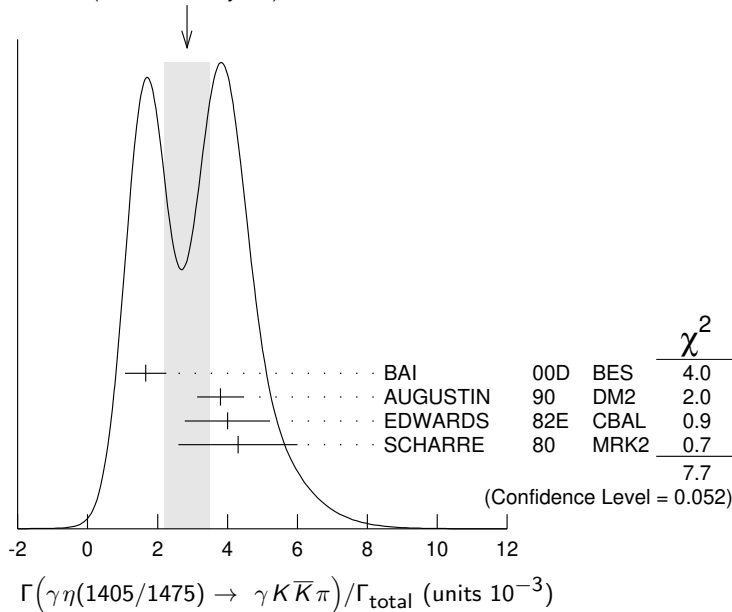
NODE=M070R89;LINKAGE=K8

NODE=M070R89;LINKAGE=D

NODE=M070R89;LINKAGE=E

- ¹ Interference with the $J/\psi(1S)$ radiative transition to the broad $K \bar{K} \pi$ pseudoscalar state around 1800 is $(0.15 \pm 0.01 \pm 0.05) \times 10^{-3}$.
- ² Interference with $J/\psi \rightarrow \gamma f_1(1420)$ is $(-0.03 \pm 0.01 \pm 0.01) \times 10^{-3}$.
- ³ Includes unknown branching fraction $\eta(1405) \rightarrow K \bar{K} \pi$.
- ⁴ Corrected for spin-zero hypothesis for $\eta(1405)$.
- ⁵ From fit to the $a_0(980) \pi 0^- +$ partial wave.
- ⁶ $a_0(980) \pi$ mode.
- ⁷ From fit to the $K^*(892) K 0^- +$ partial wave.
- ⁸ $K^* K$ mode.
- ⁹ From $a_0(980) \pi$ final state.
- ¹⁰ From $K^*(890) K$ final state.

WEIGHTED AVERAGE
 2.8 ± 0.6 (Error scaled by 1.6)



$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{271}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
0.78 ± 0.20 OUR AVERAGE	Error includes scale factor of 1.8.		
$1.07 \pm 0.17 \pm 0.11$	¹ BAI	04J	BES2 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
$0.64 \pm 0.12 \pm 0.07$	¹ COFFMAN	90	MRK3 $J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

- ¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.

NODE=M070S30
NODE=M070S30

NODE=M070S30;LINKAGE=C

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{272}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.5 OUR AVERAGE				
$2.6 \pm 0.7 \pm 0.4$		BAI	99	BES $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$3.38 \pm 0.33 \pm 0.64$		¹ BOLTON	92B	MRK3 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.0 \pm 0.6 \pm 1.1$	261	² AUGUSTIN	90	DM2 $J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

- ¹ Via $a_0(980)\pi$.

- ² Includes unknown branching fraction to $\eta\pi^+\pi^-$.

NODE=M070S29
NODE=M070S29

NODE=M070S29;LINKAGE=RR
NODE=M070S29;LINKAGE=R

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{273}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.3.		
2.1 ± 0.4	BUGG	95	MRK3 $J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$
1.36 ± 0.38	^{1,2} BISELLO	89B	DM2 $J/\psi \rightarrow 4\pi\gamma$

- ¹ Estimated by us from various fits.

- ² Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S19
NODE=M070S19

NODE=M070S19;LINKAGE=A
NODE=M070S19;LINKAGE=B

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi)/\Gamma_{\text{total}}$ Γ_{274}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<82	95		BAI	04J	BES2 $J/\psi \rightarrow \gamma\gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.03 \pm 0.92 \pm 0.91$	1.3k	¹ ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
$10.36 \pm 1.51 \pm 1.54$	1.9k	² ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$

¹ Constructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.² Destructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.NODE=M070R77
NODE=M070R77

OCCUR=2

NODE=M070R77;LINKAGE=B

NODE=M070R77;LINKAGE=A

 $\Gamma(\gamma\eta(1405) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{275}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.63 $\times 10^{-6}$	90	ABLIKIM	18O	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- \gamma\gamma\gamma$

NODE=M070P38
NODE=M070P38 $\Gamma(\gamma\eta(1475) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{276}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.86 $\times 10^{-6}$	90	ABLIKIM	18O	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- \gamma\gamma\gamma$

NODE=M070P39
NODE=M070P39 $\Gamma(\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{277}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.13 $\pm$ 0.09	^{1,2} BISELLO	89B	DM2 $J/\psi \rightarrow 4\pi\gamma$

NODE=M070S20
NODE=M070S20¹ Estimated by us from various fits.² Includes unknown branching fraction to $\rho^0\rho^0$.NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B $\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{278}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.98 $\pm$ 0.08 $\pm$ 0.32	1045	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$

NODE=M070R04
NODE=M070R04 $\Gamma(\gamma\eta(1760) \rightarrow \gamma\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{279}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.80 $\times 10^{-6}$	90	ABLIKIM	18O	BES3 $\psi(2S) \rightarrow \pi^+ \pi^- \gamma\gamma\gamma$

NODE=M070P40
NODE=M070P40 $\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}}$ Γ_{280}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

3.14 $^{+0.50}_{-0.19}$ OUR AVERAGENODE=M070S21
NODE=M070S21

$2.40 \pm 0.10^{+2.47}_{-0.18}$		^{1,2} ABLIKIM	16N	BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$4.4 \pm 0.4 \pm 0.8$	196	² ABLIKIM	08I	BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$3.3 \pm 0.8 \pm 0.5$		² BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
$2.7 \pm 0.6 \pm 0.6$		² BAI	90B	MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
$2.4^{+1.5}_{-1.0}$		^{3,4} BISELLO	89B	DM2	$J/\psi \rightarrow 4\pi\gamma$

OCCUR=2

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$ that also finds significant signals for for $\eta(2100)$, 0^-+ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^-+ state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).² Includes unknown branching fraction to $\phi\phi$.³ Estimated by us from various fits.⁴ Includes unknown branching fraction to $\rho^0\rho^0$.

NODE=M070S21;LINKAGE=C

NODE=M070S21;LINKAGE=U
NODE=M070S21;LINKAGE=A
NODE=M070S21;LINKAGE=B $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{281}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.63 $\pm$ 0.12 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.NODE=M070R86
NODE=M070R86

$2.07 \pm 0.16^{+0.02}_{-0.07}$	2.4k	^{1,2} DOBBS	15		$J/\psi \rightarrow \gamma\pi\pi$
$1.63 \pm 0.26^{+0.02}_{-0.05}$		³ ABLIKIM	06V	BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma\pi^+ \pi^-$
$1.42 \pm 0.21^{+0.02}_{-0.05}$		⁴ ABLIKIM	06V	BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma\pi^0 \pi^0$
$1.33 \pm 0.05 \pm 0.20$		⁵ AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma\pi^+ \pi^-$
$1.36 \pm 0.09 \pm 0.23$		⁵ BALTRUSAIT.	87	MRK3	$J/\psi \rightarrow \gamma\pi^+ \pi^-$
$1.48 \pm 0.25 \pm 0.30$	178	EDWARDS	82B	CBAL	$e^+ e^- \rightarrow 2\pi^0 \gamma$
2.0 ± 0.7	35	ALEXANDER	78	PLUT	$e^+ e^-$
1.2 ± 0.6	30	⁶ BRANDELIK	78B	DASP	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.744 \pm 0.052 \pm 0.122) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.371 \pm 0.010 \pm 0.222) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ ABLIKIM 06V reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi\pi)] = (1.200 \pm 0.027 \pm 0.174) \times 10^{-3}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi\pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ Estimated using $B(f_2(1270) \rightarrow \pi\pi) = 0.843 \pm 0.012$. The errors do not contain the uncertainty in the $f_2(1270)$ decay.

⁶ Restated by us to take account of spread of E1, M2, E3 transitions.

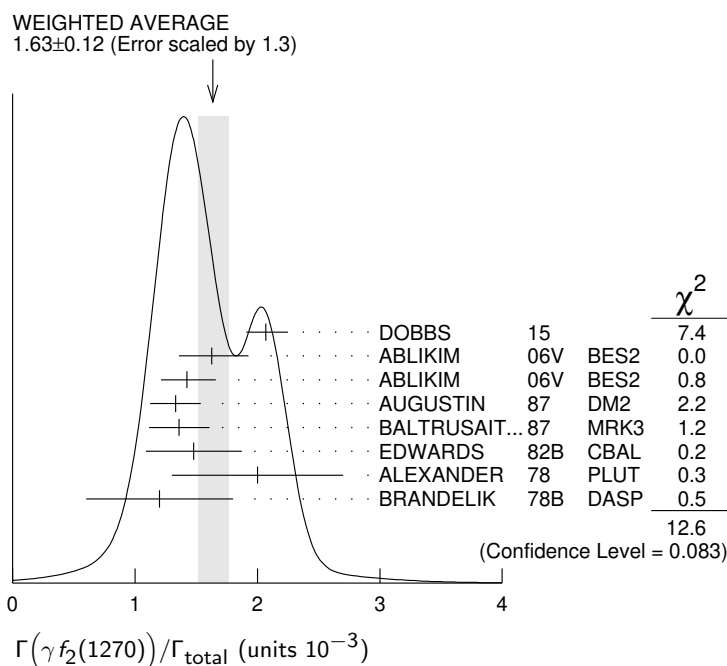
NODE=M070R86;LINKAGE=A
NODE=M070R86;LINKAGE=DO

NODE=M070R86;LINKAGE=AI

NODE=M070R86;LINKAGE=AL

NODE=M070R86;LINKAGE=X

NODE=M070R86;LINKAGE=T



$\Gamma(\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$

Γ_{282}/Γ

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

2.58^{+0.08+0.59}_{-0.09-0.20}

ABLIKIM

18AA BES3

$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P68
NODE=M070P68

$\Gamma(\gamma f_1(1285))/\Gamma_{\text{total}}$

Γ_{283}/Γ

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.61 ± 0.08 OUR AVERAGE

0.69 ± 0.16 ± 0.20

1 BAI

04J

BES2

$J/\psi \rightarrow \gamma \gamma \rho^0$

0.61 ± 0.04 ± 0.21

2 BAI

00D

BES

$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

0.45 ± 0.09 ± 0.17

3 BAI

99

BES

$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

0.625 ± 0.063 ± 0.103

4 BOLTON

92

MRK3

$J/\psi \rightarrow \gamma f_1(1285)$

0.70 ± 0.08 ± 0.16

5 BOLTON

92B

MRK3

$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M070R88
NODE=M070R88

¹ Assuming $B(f_1(1285) \rightarrow \rho^0 \gamma) = 0.055 \pm 0.013$.

² Assuming $\Gamma(f_1(1285) \rightarrow K \bar{K} \pi)/\Gamma_{\text{total}} = 0.090 \pm 0.004$.

³ Assuming $\Gamma(f_1(1285) \rightarrow \eta \pi \pi)/\Gamma_{\text{total}} = 0.5 \pm 0.18$.

⁴ Obtained summing the sequential decay channels

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \pi \pi \pi \pi) = (1.44 \pm 0.39 \pm 0.27) \times 10^{-4}$;
 $B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow \eta \pi) = (3.90 \pm 0.42 \pm 0.87) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow a_0(980) \pi, a_0(980) \rightarrow K \bar{K}) = (0.66 \pm 0.26 \pm 0.29) \times 10^{-4}$;

$B(J/\psi \rightarrow \gamma f_1(1285), f_1(1285) \rightarrow \gamma \rho^0) = (0.25 \pm 0.07 \pm 0.03) \times 10^{-4}$.

⁵ Using $B(f_1(1285) \rightarrow a_0(980) \pi) = 0.37$, and including unknown branching ratio for $a_0(980) \rightarrow \eta \pi$.

NODE=M070R88;LINKAGE=BI
NODE=M070R88;LINKAGE=BD
NODE=M070R88;LINKAGE=BA
NODE=M070R88;LINKAGE=B

NODE=M070R88;LINKAGE=A

$\Gamma(\gamma f_0(1370) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{284} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

38 ± 10	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P92
 NODE=M070P92

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{285} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

$4.19 \pm 0.73 \pm 1.34$	478	¹ DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.3 ± 0.4	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070R00
 NODE=M070R00

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070R00;LINKAGE=A

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{286} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

$1.07^{+0.08+0.36}_{-0.07-0.34}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P63
 NODE=M070P63

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{287} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.5 ± 1.0	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P93
 NODE=M070P93

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$ Γ_{288} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.9 ± 0.3	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070P94
 NODE=M070P94

 $\Gamma(\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$ Γ_{289} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

0.79 ± 0.13 OUR AVERAGE

$0.68 \pm 0.04 \pm 0.24$	BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

$0.76 \pm 0.15 \pm 0.21$	^{1,2} AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

$0.87 \pm 0.14^{+0.14}_{-0.11}$	¹ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=2

¹ Included unknown branching fraction $f_1(1420) \rightarrow K \bar{K} \pi$.² From fit to the $K^*(892)K 1^{++}$ partial wave.

NODE=M070S31;LINKAGE=A
 NODE=M070S31;LINKAGE=D

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{290} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.09 ± 0.24 OUR AVERAGE

$1.21 \pm 0.29 \pm 0.24$	174	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$

$1.00 \pm 0.03 \pm 0.45$		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

$1.02 \pm 0.09 \pm 0.45$		² ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.90 ± 0.17	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

5.7 ± 0.8	^{3,4} BUGG	95	MRK3 $J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Including unknown branching fraction to $\pi\pi$.³ Including unknown branching ratio for $f_0(1500) \rightarrow \pi^+ \pi^- \pi^+ \pi^-$.⁴ Assuming that $f_0(1500)$ decays only to two S-wave dipions.

NODE=M070S32;LINKAGE=C
 NODE=M070S32;LINKAGE=AB
 NODE=M070S32;LINKAGE=A
 NODE=M070S32;LINKAGE=B

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{291} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

$1.65^{+0.26+0.51}_{-0.31-1.40}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.1 ± 0.4	SARANTSEV	21	RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070S83
 NODE=M070S83

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S83;LINKAGE=A

$\Gamma(\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{292}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 $1.59 \pm 0.16^{+0.18}_{-0.56}$

ABLIKIM

18AA BES3

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 0.7 ± 0.3

SARANTSEV

21

RVUE

 $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ $\Gamma(\gamma f_0(1500) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{293}/Γ VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $18.1 \pm 1.1^{+1.9}_{-1.3}$ ¹ ABLIKIM

22AS BES3

 $J/\psi(1S) \rightarrow \gamma \eta \eta'$ 12 ± 5

SARANTSEV

21

RVUE

 $J/\psi(1S) \rightarrow \gamma (\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ ¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave. $\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{294}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 $4.5 \pm 1.0 \pm 0.7$

BAI

99

BES

 $J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$ $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{295}/Γ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

 $5.7^{+0.8}_{-0.5}$ **OUR AVERAGE**

Error includes scale factor of 1.5. See the ideogram

below. $[(5.7^{+0.8}_{-0.5}) \times 10^{-4}]$ OUR 2023 AVERAGE Scale factor = 1.5] $8.0 \pm 0.9 \pm 0.2$

750

^{1,2} DOBBS

15

 $J/\psi \rightarrow \gamma K\bar{K}$ $3.85 \pm 0.17^{+1.91}_{-0.73}$ ³ BAI

03G

BES

 $J/\psi \rightarrow \gamma K\bar{K}$ $3.6 \pm 0.4^{+1.4}_{-0.4}$ ³ BAI

96C

BES

 $J/\psi \rightarrow \gamma K^+ K^-$ $5.6 \pm 1.4 \pm 0.9$ ³ AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K^+ K^-$ $4.5 \pm 0.4 \pm 0.9$ ³ AUGUSTIN

88

DM2

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ $6.8 \pm 1.6 \pm 1.4$ ³ BALTRUSAIT..87

MRK3

 $J/\psi \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 <3.4

90

4

⁴ BRANDELIK

79C

DASP

 $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$ <2.3

90

3

ALEXANDER

78

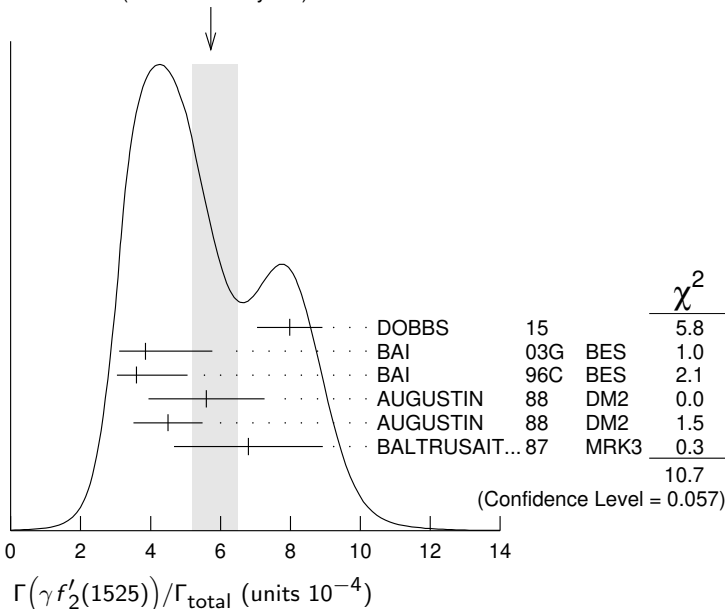
PLUT

 $e^+ e^- \rightarrow K^+ K^- \gamma$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.² DOBBS 15 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] =$ $(7.09 \pm 0.46 \pm 0.67) \times 10^{-4}$ which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K})$ $= (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Using $B(f'_2(1525) \rightarrow K\bar{K}) = 0.888$.⁴ Assuming isotropic production and decay of the $f'_2(1525)$ and isospin.NODE=M070P64
NODE=M070P64NODE=M070P99
NODE=M070P99

NODE=M070P99;LINKAGE=A

NODE=M070S36
NODE=M070S36NODE=M070R87
NODE=M070R87

NEW

OCCUR=3
OCCUR=4
OCCUR=2NODE=M070R87;LINKAGE=B
NODE=M070R87;LINKAGE=D0NODE=M070R87;LINKAGE=A1
NODE=M070R87;LINKAGE=IWEIGHTED AVERAGE
 $5.7 \pm 0.8 \pm 0.5$ (Error scaled by 1.5)

$\Gamma(\gamma f_2(1565) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$ Γ_{298}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.32 \pm 0.05^{+0.12}_{-0.02}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q31
NODE=M070Q31

NODE=M070Q31;LINKAGE=A

 $\Gamma(\gamma f'_2(1525) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{296}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

$7.99^{+0.03+0.69}_{-0.04-0.50}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P69
NODE=M070P69

 $\Gamma(\gamma f'_2(1525) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{297}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

$3.42^{+0.43+1.37}_{-0.51-1.30}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S86
NODE=M070S86

NODE=M070S86;LINKAGE=A

 $\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$ Γ_{299}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

$0.28 \pm 0.05 \pm 0.17$	141	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R02
NODE=M070R02

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{300}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

3.8 ± 0.5 OUR AVERAGE

$3.72 \pm 0.30 \pm 0.43$	483	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
$3.96 \pm 0.06 \pm 1.12$		² ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$
$3.99 \pm 0.15 \pm 2.64$		² ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 ± 0.2		³ SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
$2.5 \pm 1.6 \pm 0.8$		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Including unknown branching fraction to $\pi \pi$.

³ There is a further $(2.4 \pm 0.8) \times 10^{-4}$ scalar contribution at 1765 MeV.

NODE=M070B01
NODE=M070B01

OCCUR=2

NODE=M070B01;LINKAGE=A
NODE=M070B01;LINKAGE=AB
NODE=M070B01;LINKAGE=B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{301}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

9.5 ± 1.0 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

$8.00^{+0.12+1.24}_{-0.08-0.40}$		¹ ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$11.76 \pm 0.54 \pm 0.94$	1.2k	² DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$
$9.62 \pm 0.29^{+3.51}_{-1.86}$		³ BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
$5.0 \pm 0.8^{+1.8}_{-0.4}$		^{1,4} BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
$9.2 \pm 1.4 \pm 1.4$		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
$10.4 \pm 1.2 \pm 1.6$		¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$9.6 \pm 1.2 \pm 1.8$		¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.3 ± 0.8		⁵ SARANTSEV	21 RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$
$1.6 \pm 0.2^{+0.6}_{-0.2}$		^{1,6} BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
< 0.8	90	⁷ BISELLO	89B	$J/\psi \rightarrow 4\pi \gamma$
$1.6 \pm 0.4 \pm 0.3$		⁸ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.8 ± 1.6		⁹ EDWARDS	82D CBAL	$e^+ e^- \rightarrow \eta \eta \gamma$

NODE=M070R91
NODE=M070R91

OCCUR=2

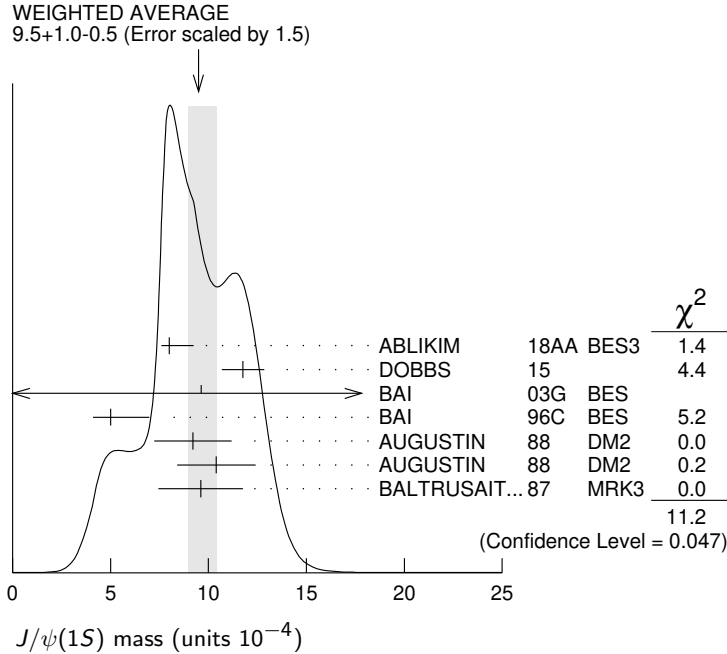
OCCUR=2

OCCUR=2

- ¹ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$. We have multiplied $K^+ K^-$ measurement by 2, and $K_S^0 K_S^0$ by 4 to obtain $K \bar{K}$ result.
- ² Using CLEO-c data but not authored by the CLEO Collaboration.
- ³ Includes unknown branching ratio to $K^+ K^-$ or $K_S^0 K_S^0$.
- ⁴ Assuming $J^P = 2^+$ for $f_0(1710)$.
- ⁵ There is a further $(6 \pm 2) \times 10^{-4}$ scalar contribution at 1765 MeV.
- ⁶ Assuming $J^P = 0^+$ for $f_0(1710)$.
- ⁷ Includes unknown branching fraction to $\rho^0 \rho^0$.
- ⁸ Includes unknown branching fraction to $\pi^+ \pi^-$.
- ⁹ Includes unknown branching fraction to $\eta \eta$.

NODE=M070R91;LINKAGE=B

NODE=M070R91;LINKAGE=D
 NODE=M070R91;LINKAGE=K9
 NODE=M070R91;LINKAGE=A1
 NODE=M070R91;LINKAGE=E
 NODE=M070R91;LINKAGE=A2
 NODE=M070R91;LINKAGE=C
 NODE=M070R91;LINKAGE=Z
 NODE=M070R91;LINKAGE=A



$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$					Γ_{302} / Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.31 ± 0.06 ± 0.08	180	ABLIKIM	06H	BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070R01
 NODE=M070R01

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$					Γ_{303} / Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.35^{+0.13+1.24}_{-0.11-0.74}	5.5k	¹ ABLIKIM	13N	BES3	$J/\psi \rightarrow \gamma \eta \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.2 ± 0.4		² SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070S84
 NODE=M070S84

- ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
- ² There is a further $(0.7 \pm 0.1) \times 10^{-4}$ scalar contribution at 1765 MeV.

NODE=M070S84;LINKAGE=A

NODE=M070S84;LINKAGE=B

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$					Γ_{304} / Γ
VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT		
6.5 ± 2.5	¹ SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$	
¹ There is a further $(2.5 \pm 1.1) \times 10^{-5}$ scalar contribution at 1765 MeV.					

NODE=M070Q00
 NODE=M070Q00

NODE=M070Q00;LINKAGE=A

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \phi) / \Gamma_{\text{total}}$					Γ_{305} / Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.5 ± 0.6 OUR AVERAGE					
2.00 ± 0.08 ^{+1.38} _{-1.64}	1.3k	ABLIKIM	13J	BES3	$J/\psi \rightarrow \gamma \omega \phi$
2.61 ± 0.27 ± 0.65	95	ABLIKIM	06J	BES2	$J/\psi \rightarrow \gamma \omega \phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.1 ± 0.1		¹ SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$
¹ There is a further $(2.2 \pm 0.4) \times 10^{-4}$ scalar contribution at 1765 MeV.					

NODE=M070S79
 NODE=M070S79

NODE=M070S79;LINKAGE=A

$\Gamma(\gamma f_0(1770) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{306}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 $1.11 \pm 0.06^{+0.19}_{-0.32}$

ABLIKIM

18AA BES3

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ NODE=M070P65
NODE=M070P65 $\Gamma(\gamma f_0(1770) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{309}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $0.11 \pm 0.01^{+0.04}_{-0.03}$ ¹ ABLIKIM

22AS BES3

 $J/\psi(1S) \rightarrow \gamma \eta \eta'$ NODE=M070Q30
NODE=M070Q30¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q30;LINKAGE=A

 $\Gamma(\gamma f_2(1810) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{307}/Γ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

COMMENT

 $5.40^{+0.60+3.42}_{-0.67-2.35}$

5.5k

¹ ABLIKIM

13N

 $J/\psi \rightarrow \gamma \eta \eta$ NODE=M070S87
NODE=M070S87¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S87;LINKAGE=A

 $\Gamma(\gamma \eta_1(1855) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{308}/Γ VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

 $2.70 \pm 0.41^{+0.16}_{-0.35}$ ¹ ABLIKIM

22AI BES3

 $J/\psi(1S) \rightarrow \gamma \eta \eta'$ NODE=M070Q44
NODE=M070Q44¹ From a Breit-Wigner fit involving 9 resonances and the resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave. For analysis details see ABLIKIM 22AS.

NODE=M070Q44;LINKAGE=A

 $\Gamma(\gamma f_2(1910) \rightarrow \gamma \omega \omega)/\Gamma_{\text{total}}$ Γ_{310}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $0.20 \pm 0.04 \pm 0.13$

151

ABLIKIM

06H BES

 $J/\psi \rightarrow \gamma \omega \omega$ NODE=M070R03
NODE=M070R03 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{311}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 $0.7 \pm 0.1 \pm 0.2$

BAI

00B

BES

 $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$ NODE=M070B06
NODE=M070B06 $\Gamma(\gamma f_2(2010) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{312}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $0.71 \pm 0.06^{+0.10}_{-0.06}$ ¹ ABLIKIM

22AS BES3

 $J/\psi(1S) \rightarrow \gamma \eta \eta'$ NODE=M070Q37
NODE=M070Q37¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q37;LINKAGE=A

 $\Gamma(\gamma f_0(2020) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{313}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

42 $\pm$ 10

SARANTSEV 21

RVUE

 $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q01
NODE=M070Q01 $\Gamma(\gamma f_0(2020) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{314}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

55 $\pm$ 25

SARANTSEV 21

RVUE

 $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q02
NODE=M070Q02 $\Gamma(\gamma f_0(2020) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{315}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

10 $\pm$ 10

SARANTSEV 21

RVUE

 $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$ NODE=M070Q03
NODE=M070Q03 $\Gamma(\gamma f_0(2020) \rightarrow \gamma \eta' \eta')/\Gamma_{\text{total}}$ Γ_{316}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

 $2.63 \pm 0.06^{+0.31}_{-0.46}$ ¹ ABLIKIM

22C

BES3

 $J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$ NODE=M070Q25
NODE=M070Q25¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q25;LINKAGE=A

$\Gamma(\gamma f_0(2020) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{317}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.28 \pm 0.12^{+0.29}_{-0.20}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q35
NODE=M070Q35

NODE=M070Q35;LINKAGE=A

 $\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ Γ_{318}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

$2.7 \pm 0.5 \pm 0.5$	¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

¹ Assuming branching fraction $f_4(2050) \rightarrow \pi \pi$ / total = 0.167.

NODE=M070S7
NODE=M070S7

NODE=M070S7;LINKAGE=V

 $\Gamma(\gamma f_4(2050) \rightarrow \gamma \eta \eta')/\Gamma_{\text{total}}$ Γ_{319}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.06 \pm 0.01^{+0.03}_{-0.01}$	¹ ABLIKIM	22AS BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P-wave.

NODE=M070Q32
NODE=M070Q32

NODE=M070Q32;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{320}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

$1.13^{+0.09+0.64}_{-0.10-0.28}$	5.5k	¹ ABLIKIM	13N BES3	$J/\psi \rightarrow \gamma \eta \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.8 ± 1.5	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S85
NODE=M070S85

NODE=M070S85;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{322}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

$6.24 \pm 0.48 \pm 0.87$	744	¹ DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.0 ± 0.8	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B08
NODE=M070B08

NODE=M070B08;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{321}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

32 ± 20	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

NODE=M070Q04
NODE=M070Q04

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{323}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.5	¹ AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

¹ Includes unknown branching fraction to $K_S^0 K_S^0$.

NODE=M070S18
NODE=M070S18

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{326}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

5 ± 2	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

NODE=M070Q05
NODE=M070Q05

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{324}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

$5.86 \pm 0.49 \pm 1.20$	490	¹ DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.5 ± 0.5	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma (\pi \pi, K \bar{K}, \eta \eta, \omega \phi)$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B09
NODE=M070B09

NODE=M070B09;LINKAGE=A

$\Gamma(\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{325}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$2.72^{+0.08+0.17}_{-0.06-0.47}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P66
NODE=M070P66

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{327}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.7 ± 0.4	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070Q06
NODE=M070Q06

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{328}/Γ

VALUE (units 10^{-5})	CL%	EVS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>300			¹ BAI	96B BES	$e^+e^- \rightarrow \gamma \bar{p}p, K\bar{K}$
>250	99.9		² HASAN	96 SPEC	$\bar{p}p \rightarrow \pi^+\pi^-$
< 2.3	95		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-$
< 1.6	95		³ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$12.4^{+6.4}_{-5.2} \pm 2.8$		23	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$
$8.4^{+3.4}_{-2.8} \pm 1.6$		93	³ BALTRUSAIT..86D	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$

NODE=M070R92
NODE=M070R92

OCCUR=2

OCCUR=2

¹ Using BARNES 93.

² Using BAI 96B.

³ Includes unknown branching fraction to $K^+ K^-$ or $K_S^0 K_S^0$.

NODE=M070R92;LINKAGE=A
NODE=M070R92;LINKAGE=M
NODE=M070R92;LINKAGE=W

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{329}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.9	90	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$14 \pm 8 \pm 4$		BAI	98H BES	$J/\psi \rightarrow \gamma \pi^0 \pi^0$
$8.4 \pm 2.6 \pm 3.0$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M070B02
NODE=M070B02

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+ \pi^-$ and $\pi^0 \pi^0$ are $2.6/5.2 \times 10^{-5}$ and $1.3/1.9 \times 10^{-5}$, respectively.

NODE=M070B02;LINKAGE=A
NODE=M070B02;LINKAGE=DO

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{330}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma K \bar{K}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 3.6		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
< 2.9		³ DEL-AMO-SA..100	BABR	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$
$6.6 \pm 2.9 \pm 2.4$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K^+ K^-$
$10.8 \pm 4.0 \pm 3.2$		BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070B03
NODE=M070B03

OCCUR=2

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $K^+ K^-$ and $K_S^0 K_S^0$ are $1.7/3.1 \times 10^{-5}$ and $1.2/2.0 \times 10^{-5}$, respectively.

³ For spin 2 and helicity 0; other combinations lead to more stringent upper limits.

NODE=M070B03;LINKAGE=A
NODE=M070B03;LINKAGE=DO

NODE=M070B03;LINKAGE=DE

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{331}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.6 \pm 0.5$	BAI	96B BES	$e^+e^- \rightarrow J/\psi \rightarrow \gamma p \bar{p}$

NODE=M070B04
NODE=M070B04

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{332}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$4.95 \pm 0.21^{+0.66}_{-0.72}$	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P67
NODE=M070P67

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 ± 0.1 SARANTSEV 21 RVUE $J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{333}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4 ± 2	SARANTSEV 21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070Q07
NODE=M070Q07

$\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{334} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.5 ± 0.4	SARANTSEV	21	RVUE	$J/\psi(1S) \rightarrow \gamma(\pi\pi, K\bar{K}, \eta\eta, \omega\phi)$

NODE=M070Q08
NODE=M070Q08

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}}$ Γ_{335} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT

$6.09 \pm 0.64^{+4.00}_{-1.68}$	1 ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q26
NODE=M070Q26

NODE=M070Q26;LINKAGE=A

 $\Gamma(\gamma f_0(2330) \rightarrow \gamma \eta \eta') / \Gamma_{\text{total}}$ Γ_{336} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.10 \pm 0.02^{+0.01}_{-0.02}$	1 ABLIKIM	22AS	BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta'$

¹ From a Breit-Wigner fit involving 9 resonances and a resonating exotic $\eta_1(1855) \rightarrow \eta \eta'$ P -wave.

NODE=M070Q36
NODE=M070Q36

NODE=M070Q36;LINKAGE=A

 $\Gamma(\gamma f_0(2470) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}}$ Γ_{340} / Γ

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT

$8.18 \pm 1.77^{+3.73}_{-2.23}$	1 ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q27
NODE=M070Q27

NODE=M070Q27;LINKAGE=A

 $\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$ Γ_{337} / Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

$5.60^{+0.62+2.37}_{-0.65-2.07}$	5.5k	1 ABLIKIM	13N	BES3	$J/\psi \rightarrow \gamma \eta \eta$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S88
NODE=M070S88

NODE=M070S88;LINKAGE=A

 $\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta' \eta') / \Gamma_{\text{total}}$ Γ_{339} / Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT

$8.67 \pm 0.70^{+0.61}_{-1.67}$	1 ABLIKIM	22C	BES3	$J/\psi \rightarrow \gamma \eta' \eta' \rightarrow 4/5 \gamma 2(\pi^+ \pi^-)$

¹ From a partial wave analysis of the systems (γX) , with $X \rightarrow \eta' \eta'$, and $(\eta' X)$, with $X \rightarrow \gamma \eta'$ in the decay $J/\psi \rightarrow \gamma \eta' \eta'$. The intermediate resonance X is parametrized by a constant-width, relativistic Breit-Wigner.

NODE=M070Q29
NODE=M070Q29

NODE=M070Q29;LINKAGE=A

 $\Gamma(\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{338} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

$5.54^{+0.34+3.82}_{-0.40-1.49}$	ABLIKIM	18AA	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070P70
NODE=M070P70

 $\Gamma(\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta') / \Gamma_{\text{total}}$ Γ_{341} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

$2.7^{+0.6}_{-0.8}$	OUR AVERAGE	Error includes scale factor of 1.6.		

$3.93 \pm 0.38^{+0.31}_{-0.84}$	1 ABLIKIM	16J	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

$2.2 \pm 0.4 \pm 0.4$	264	ABLIKIM	05R	BES2	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.87 \pm 0.09^{+0.49}_{-0.52}$	4265	2 ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

¹ From a fit of the measured $\pi^+ \pi^- \eta'$ lineshape that accounts for the abrupt distortion observed at the $p\bar{p}$ threshold with a Flatte formula in addition to known backgrounds and contributors, as well as an *ad hoc* Breit-Wigner ($M \approx 1919$ MeV; $\Gamma \approx 51$ MeV) that is required for a good fit. Another explanation for the distortion provided by ABLIKIM 16J is that a second resonance near 1870 MeV interferes with the $X(1835)$; fits to this possibility yield product branching fraction values compatible with that shown within the respective systematic uncertainties.

² From a fit of the $\pi^+ \pi^- \eta'$ mass distribution to a combination of $\gamma f_1(1510)$, $\gamma X(1835)$, and two states $\gamma X(2120)$ and $\gamma X(2370)$, for $M(\pi^+ \pi^- \eta') < 2.8$ GeV, and accounting for backgrounds from non- η' events and $J/\psi \rightarrow \pi^0 \pi^+ \pi^- \eta'$.

NODE=M070R78
NODE=M070R78

NODE=M070R78;LINKAGE=A

NODE=M070R78;LINKAGE=A

$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{342}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M070S71
NODE=M070S71

 $0.77^{+0.15}_{-0.09}$ OUR AVERAGE

$0.90^{+0.04+0.27}_{-0.11-0.55}$		¹ ABLIKIM	12D	BES3	$J/\psi \rightarrow \gamma p \bar{p}$
$1.14^{+0.43+0.42}_{-0.30-0.26}$	231	² ALEXANDER	10	CLEO	$J/\psi \rightarrow \gamma p \bar{p}$
$0.70 \pm 0.04^{+0.19}_{-0.08}$		BAI	03F	BES2	$J/\psi \rightarrow \gamma p \bar{p}$

¹ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A.

² From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma X(1835)$, γR with $M(R) = 2100$ MeV and $\Gamma(R) = 160$ MeV, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV.

NODE=M070S71;LINKAGE=AK

NODE=M070S71;LINKAGE=AL

 $\Gamma(\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta)/\Gamma_{\text{total}}$ Γ_{343}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

NODE=M070S96
NODE=M070S96

 $3.31^{+0.33+1.96}_{-0.30-1.29}$

ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \phi(1020))/\Gamma_{\text{total}}$ Γ_{344}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M070P37
NODE=M070P37

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.77 \pm 0.35 \pm 0.25$	305	¹ ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
$8.09 \pm 1.99 \pm 1.36$	1.3k	² ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$

OCCUR=2

¹ Constructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

NODE=M070P37;LINKAGE=A

² Destructive interference between the $X(1835)$ and $\eta(1405)/\eta(1475)$ is assumed in a fit to the $\gamma\phi$ invariant mass.

NODE=M070P37;LINKAGE=B

 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \gamma)/\Gamma_{\text{total}}$ Γ_{345}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M070P41
NODE=M070P41

$< 3.56 \times 10^{-6}$	90	ABLIKIM	18O	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$

 $\Gamma(\gamma X(1835) \rightarrow \gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{346}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M070S82
NODE=M070S82

$2.44 \pm 0.36^{+0.60}_{-0.74}$	0.6k	ABLIKIM	13U	BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

 $\Gamma(\gamma X(2370) \rightarrow \gamma K^+ K^- \eta')/\Gamma_{\text{total}}$ Γ_{347}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

NODE=M070P86
NODE=M070P86

$1.79 \pm 0.23 \pm 0.65$	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K^+ K^- \eta'$

 $\Gamma(\gamma X(2370) \rightarrow \gamma K_S^0 K_S^0 \eta')/\Gamma_{\text{total}}$ Γ_{348}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

NODE=M070P87
NODE=M070P87

$1.18 \pm 0.32 \pm 0.39$	ABLIKIM	20Q	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

 $\Gamma(\gamma X(2370) \rightarrow \gamma \eta \eta \eta')/\Gamma_{\text{total}}$ Γ_{349}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M070P88
NODE=M070P88

$< 9.2 \times 10^{-6}$ (CL = 90%)		[$< 9.2 \times 10^{-6}$ (CL = 90%) OUR 2023 BEST LIMIT]		

$< 9.2 \times 10^{-6}$	90	ABLIKIM	21C	BES3	$J/\psi(1S) \rightarrow \gamma \eta \eta \eta'$

 $\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{350}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M070R90
NODE=M070R90

$0.38 \pm 0.07 \pm 0.07$		49	EATON	84	MRK2 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.11	90	PERUZZI	78	MRK1	$e^+ e^-$

 $\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{351}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M070R93
NODE=M070R93

$< 0.79 \times 10^{-3}$	90	EATON	84	MRK2	$e^+ e^-$

 $\Gamma(\gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{352}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M070S8
NODE=M070S8

$< 0.13 \times 10^{-3}$	90	HENRARD	87	DM2	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 0.16 \times 10^{-3}$	90	BAI	98G	BES	$e^+ e^-$

$\Gamma(\gamma A^0 \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$ Γ_{353}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-6}$	90	88M	¹ ABLIKIM	20K BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.3 \times 10^{-6}$	90	3.7M	² INSLE	10 CLEO	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$

¹ For a narrow state, A^0 , with mass $m_{A^0} < 1.2$ GeV. The limit varies with m_{A^0} , reaching its largest value of 1.7×10^{-6} at 1.2 GeV and being 7.0×10^{-7} for $m_{A^0} = 0$.

² The limit varies with mass m_{A^0} of a narrow state A^0 and is 4.3×10^{-6} for $m_{A^0} = 0$, reaches its largest value of 6.3×10^{-6} at $m_{A^0} = 500$ MeV, and is 3.6×10^{-6} at $m_{A^0} = 960$ MeV.

NODE=M070S68
NODE=M070S68

NODE=M070S68;LINKAGE=A

NODE=M070S68;LINKAGE=IN

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{354}/Γ (narrow state A^0 with $0.2 \text{ GeV} < m_{A^0} < 3 \text{ GeV}$)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	¹ ABLIKIM	22H BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<0.5 \times 10^{-5}$	90	² ABLIKIM	16E BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$
$<2.1 \times 10^{-5}$	90	³ ABLIKIM	12 BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.212–3.0 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(1.2\text{--}778.0) \times 10^{-9}$.

² For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.212–3 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(2.8\text{--}495.3) \times 10^{-8}$.

³ For a narrow scalar or pseudoscalar, A^0 , with a mass in the range 0.21–3.00 GeV. The measured 90% CL limit as a function of m_{A^0} ranges from 4×10^{-7} to 2.1×10^{-5} .

NODE=M070S76
NODE=M070S76

NODE=M070S76;LINKAGE=B

NODE=M070S76;LINKAGE=A

NODE=M070S76;LINKAGE=AB

DALITZ DECAYS

 $\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{355}/Γ

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.56 \pm 1.32 \pm 0.50$	39	ABLIKIM	14I BES3	$J/\psi \rightarrow \pi^0 e^+ e^-$

NODE=M070S89
NODE=M070S89

 $\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{356}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.42 \pm 0.04 \pm 0.07$	2.47k	^{1,2} ABLIKIM	19A BES3	$J/\psi \rightarrow \eta e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.16 \pm 0.07 \pm 0.06$	320	¹ ABLIKIM	14I BES3	$J/\psi \rightarrow \eta e^+ e^-$

¹ Using both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

² Approximation of the transition form factor squared as an incoherent sum of the ρ -meson and one-pole non-resonant amplitudes gives the pole mass $m(\Lambda) = 2.56 \pm 0.04 \pm 0.03$ GeV. Supersedes ABLIKIM 14I.

NODE=M070S90
NODE=M070S90

NODE=M070S90;LINKAGE=A
NODE=M070S90;LINKAGE=C

 $\Gamma(\eta'(958) e^+ e^-)/\Gamma_{\text{total}}$ Γ_{357}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$6.59 \pm 0.07 \pm 0.17$	8.9k	¹ ABLIKIM	19H BES3	$J/\psi \rightarrow \eta'(958) e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$5.81 \pm 0.16 \pm 0.31$	1.4k	^{1,2} ABLIKIM	14I BES3	$J/\psi \rightarrow \eta'(958) e^+ e^-$

¹ Using both $\eta' \rightarrow \gamma \pi^+ \pi^-$ and $\eta' \rightarrow \pi^+ \pi^- \eta$ decays.

² Superseded by ABLIKIM 19H.

NODE=M070S91
NODE=M070S91

NODE=M070S91;LINKAGE=A
NODE=M070S91;LINKAGE=B

 $\Gamma(X(1835) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ Γ_{358}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.58 \pm 0.19 \pm 0.16$	1364	¹ ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+ \pi^- \eta' e^+ e^-$

¹ Assuming constructive interference. Destructive interference gives a value of $(4.43 \pm 0.23 \pm 0.19) \times 10^{-6}$ for this branching fraction.

NODE=M070Q22
NODE=M070Q22

NODE=M070Q22;LINKAGE=A

 $\Gamma(X(2120) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ Γ_{359}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.12 \pm 0.06$	310	ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+ \pi^- \eta' e^+ e^-$

NODE=M070Q24
NODE=M070Q24

 $\Gamma(X(2370) e^+ e^-, X \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}$ Γ_{360}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.08 \pm 0.14 \pm 0.10$	397	ABLIKIM	22B BES3	$J/\psi \rightarrow \pi^+ \pi^- \eta' e^+ e^-$

NODE=M070Q23
NODE=M070Q23

$\Gamma(\eta U \rightarrow \eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{361}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<9.11 \times 10^{-7}$ 90 ¹ ABLIKIM 19A BES3 $J/\psi \rightarrow \eta e^+ e^-$

¹ For a dark photon U with mass between 10 and 2400 MeV. Obtained 90% C.L. limits as a function of m_U range from 1.9×10^{-8} to 91.1×10^{-8} .

NODE=M070P42
NODE=M070P42

NODE=M070P42;LINKAGE=A

 $\Gamma(\eta'(958) U \rightarrow \eta'(958) e^+ e^-)/\Gamma_{\text{total}}$ Γ_{362}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<2.0 \times 10^{-7}$ 90 ¹ ABLIKIM 19H BES3 $J/\psi \rightarrow \eta'(958) e^+ e^-$

¹ For a dark photon U with mass between 100 and 2100 MeV. Obtained 90% C.L. limits as a function of m_U range from 1.8×10^{-8} to 2.0×10^{-7} . The corresponding limits on the branching fraction $J/\psi \rightarrow \eta' U$ range from 5.7×10^{-8} to 7.4×10^{-7} .

NODE=M070P61
NODE=M070P61

NODE=M070P61;LINKAGE=A

 $\Gamma(\phi e^+ e^-)/\Gamma_{\text{total}}$ Γ_{363}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 90 ¹ ABLIKIM 19AB BES3 $J/\psi \rightarrow \phi e^+ e^-$

¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) = (34.49 \pm 0.30)\%$.

NODE=M070P82
NODE=M070P82

NODE=M070P82;LINKAGE=A

WEAK DECAYS

 $\Gamma(D^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{364}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<7.1 \times 10^{-8}$ 90 ABLIKIM 21Q BES3 $e^+ e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1.2 \times 10^{-5}$ 90 ABLIKIM 06M BES2 $e^+ e^- \rightarrow J/\psi$

NODE=M070S53
NODE=M070S53

NODE=M070320

 $\Gamma(\bar{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{365}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<8.5 \times 10^{-8}$ 90 ¹ ABLIKIM 17AF BES3 $e^+ e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1.1 \times 10^{-5}$ 90 ABLIKIM 06M BES2 $e^+ e^- \rightarrow J/\psi$

¹ Using D^0 decays to $K^- \pi^+$, $K^- \pi^+ \pi^0$, and $K^- \pi^+ \pi^+ \pi^-$.

NODE=M070S54
NODE=M070S54

NODE=M070S54;LINKAGE=A

 $\Gamma(D_s^- e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{366}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.3 \times 10^{-6}$ 90 ABLIKIM 14R BES3 $e^+ e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<3.6 \times 10^{-5}$ 90 ¹ ABLIKIM 06M BES2 $e^+ e^- \rightarrow J/\psi$

¹ Using $B(D_s^- \rightarrow \phi \pi^-) = 4.4 \pm 0.5 \%$.

NODE=M070S55
NODE=M070S55

NODE=M070S55;LINKAGE=AB

 $\Gamma(D_s^{*-} e^+ \nu_e + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{367}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.8 \times 10^{-6}$ 90 ABLIKIM 14R BES3 $e^+ e^- \rightarrow J/\psi$

NODE=M070B13
NODE=M070B13

 $\Gamma(D^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{368}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<7.5 \times 10^{-5}$ 90 ABLIKIM 08J BES2 $e^+ e^- \rightarrow J/\psi$

NODE=M070S61
NODE=M070S61

 $\Gamma(\bar{D}^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{369}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.7 \times 10^{-4}$ 90 ABLIKIM 08J BES2 $e^+ e^- \rightarrow J/\psi$

NODE=M070S62
NODE=M070S62

 $\Gamma(\bar{D}^0 \bar{K}^{*0} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{370}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<2.5 \times 10^{-6}$ 90 ABLIKIM 14K BES3 $e^+ e^- \rightarrow J/\psi$

NODE=M070S93
NODE=M070S93

 $\Gamma(D_s^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{371}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.3 \times 10^{-4}$ 90 ABLIKIM 08J BES2 $e^+ e^- \rightarrow J/\psi$

NODE=M070S63
NODE=M070S63

$\Gamma(D_s^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{372}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-5}$	90	ABLIKIM	14K BES3	$e^+ e^- \rightarrow J/\psi$

NODE=M070S92
NODE=M070S92

———— CHARGE CONJUGATION (C), PARITY (P), ————
———— LEPTON FAMILY NUMBER (LF) VIOLATING MODES ————

NODE=M070315

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{373}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.7 \times 10^{-7}$	90	ABLIKIM	14Q BES3	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 0.5 \times 10^{-5}$	90	ADAMS	08 CLEO	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$< 1.6 \times 10^{-4}$	90	¹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$
$< 2.2 \times 10^{-5}$	90	ABLIKIM	07J BES2	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
$< 50 \times 10^{-5}$	90	BARTEL	77 CNTR	$e^+ e^-$

¹ WICHT 08 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow J/\psi(1S) K^+)] < 0.16 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.020 \times 10^{-3}$.

NODE=M070R80
NODE=M070R80

NODE=M070R80;LINKAGE=WI

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{374}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-6}$	90	ABLIKIM	14Q BES3	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S95
NODE=M070S95

 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{375}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-7}$	90	ABLIKIM	13L BES3	$e^+ e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1.1 \times 10^{-6}$	90	BAI	03D BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070S39
NODE=M070S39

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{376}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.5 \times 10^{-8}$	90	ABLIKIM	21M BES3	$e^+ e^- \rightarrow J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<8.3 \times 10^{-6}$	90	¹ ABLIKIM	04 BES	$e^+ e^- \rightarrow J/\psi$

¹ Superseded by ABLIKIM 21M.

NODE=M070S40
NODE=M070S40

NODE=M070S40;LINKAGE=A

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{377}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-6}$	90	ABLIKIM	04 BES	$e^+ e^- \rightarrow J/\psi$

NODE=M070S41
NODE=M070S41

 $\Gamma(\Lambda_c^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{378}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.9 \times 10^{-8}$	90	ABLIKIM	19AF BES3	$e^+ e^- \rightarrow J/\psi \rightarrow p K^- \pi^+ e^- (+ \text{c.c.})$

NODE=M070P74
NODE=M070P74

———— OTHER DECAYS ————

NODE=M070325

 $\Gamma(\text{invisible})/\Gamma(e^+ e^-)$ Γ_{379}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-2}$	90	LEES	13I BABR	$B \rightarrow K^{(*)} J/\psi$

NODE=M070S80
NODE=M070S80

 $\Gamma(\text{invisible})/\Gamma(\mu^+ \mu^-)$ Γ_{379}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-2}$	90	ABLIKIM	08G BES2	$\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

NODE=M070S60
NODE=M070S60

$J/\psi(1S)$ REFERENCES

NODE=M070

ABLIKIM	23BD	PR D108 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62425
ABLIKIM	23BU	PR D108 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62517
ABLIKIM	23S	PR D107 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62063
ANASHIN	23	JHEP 2306 196	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=62057
GONG	23	PR D107 072008	G. Gong <i>et al.</i>	(BELLE Collab.)	REFID=62073
LEES	23	PR D107 072001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=62061
LIAO	23	PR D107 112007	L. Liao <i>et al.</i>		REFID=62279
ZHU	23	PR D107 012006	W. Zhu <i>et al.</i>	(BELLE Collab.)	REFID=61911
ABLIKIM	22AI	PRL 129 192002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61881
Also		PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
ABLIKIM	22AS	PR D106 072012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61891
Also		PR D107 079901 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62033
ABLIKIM	22AY	PR D106 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61902
ABLIKIM	22B	PRL 129 022002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61636

ABLIKIM	22C	PR D105 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61637
ABLIKIM	22H	PR D105 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61643
ANASHIN	22	EPJ C82 938	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=61894
ABLIKIM	21AM	PR D104 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61445
ABLIKIM	21AT	JHEP 2111 226	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61463
ABLIKIM	21C	PR D103 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61030
ABLIKIM	21M	PR D103 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61118
ABLIKIM	21Q	JHEP 2106 157	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61125
LEES	21	PR D103 092001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61113
LEES	21B	PR D104 112003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61450
LEES	21C	PR D104 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61451
SARANTSEV	21	PL B816 136227	A.V. Sarantsev <i>et al.</i>	(BONN, PNPI)	REFID=61091
ABLIKIM	20	PR D101 012004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60048
ABLIKIM	20K	PR D101 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60316
ABLIKIM	20Q	EPJ C80 746	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60457
ANASHIN	20	JHEP 2007 112	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=60512
ABLIKIM	19A	PR D99 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59517
Also		PR D104 099901 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61449
ABLIKIM	19AB	PR D99 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59846
ABLIKIM	19AC	PR D99 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59850
ABLIKIM	19AF	PR D99 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59857
ABLIKIM	19AN	PR D99 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59890
ABLIKIM	19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
ABLIKIM	19H	PR D99 012013	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59604
ABLIKIM	19N	PR D99 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59615
ABLIKIM	19Q	PL B791 375	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59747
ABLIKIM	19T	PRL 122 142002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59773
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)	REFID=59614
ABLIKIM	18AA	PR D98 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59455
ABLIKIM	18AB	PR D98 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59456
ABLIKIM	18D	PRL 121 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58849
ABLIKIM	18I	PR D97 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58893
ABLIKIM	18O	PR D97 072014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58925
ANASHIN	18A	JHEP 1805 119	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=59102
LEES	18	PR D97 052007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58900
LEES	18E	PR D98 112015	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=59505
ABLIKIM	17AF	PR D96 111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58315
ABLIKIM	17AH	PR D96 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58317
ABLIKIM	17AK	PR D96 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58324
ABLIKIM	17E	PL B770 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57903
ABLIKIM	17L	PR D95 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57967
LEES	17A	PR D95 052001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57966
LEES	17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
LEES	17D	PR D95 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57990
ABLIKIM	16E	PR D93 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57265
ABLIKIM	16J	PRL 117 042002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57454
ABLIKIM	16K	PR D93 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57509
ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57510
ABLIKIM	16M	PR D93 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57511
ABLIKIM	16N	PR D93 112011	M. Ablikim	(BESIII Collab.)	REFID=57512
ABLIKIM	16P	PR D94 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57522
ABLIKIM	16Q	PL B761 98	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57566
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
AAIJ	15BI	EPJ C75 311	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57147
ABLIKIM	15AE	PR D92 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56984
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56773
ABLIKIM	15K	PR D91 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56776
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
ABLIKIM	15T	PRL 115 091803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56785
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988
ABLIKIM	14I	PR D89 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55900
ABLIKIM	14K	PR D89 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55902
ABLIKIM	14N	PR D90 052009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55905
ABLIKIM	14Q	PR D90 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56238
ABLIKIM	14R	PR D90 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56388
ANASHIN	14	PL B738 391	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56130
AULCHENKO	14	PL B731 227	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=55655
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54920
ABLIKIM	13I	PR D87 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54954
ABLIKIM	13J	PR D87 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54955
ABLIKIM	13L	PR D87 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55300
ABLIKIM	13N	PR D87 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55387
ABLIKIM	13P	PR D87 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55392
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55402
ABLIKIM	13U	PR D88 091502	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55582
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
ABLIKIM	12	PR D85 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54265
ABLIKIM	12B	PR D86 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54267
ABLIKIM	12C	PR D86 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54268
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54269
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54273
ABLIKIM	12P	CP C36 1031	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=54863
LEES	12E	PR D85 112009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54297
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
ABLIKIM	11	PR D83 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53646
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53684
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16715
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53349
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53361
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
ANASHIN	10	PL B685 134	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=53220
DEL-AMO-SA...	100	PRL 105 172001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53533
INSLER	10	PR D81 091101	J. Insler <i>et al.</i>	(CLEO Collab.)	REFID=53359

ABLIKIM	09	PL B676 25	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52718
ABLIKIM	09B	PR D80 052004	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53099
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000
ABLIKIM	08	EPJ C53 15	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52047
ABLIKIM	08A	PR D77 012001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52128
ABLIKIM	08C	PL B659 789	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52130
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52154
ABLIKIM	08G	PRL 100 192001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52253
ABLIKIM	08I	PL B662 330	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52255
ABLIKIM	08J	PL B663 297	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52256
ABLIKIM	08O	PR D78 092005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52571
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=52261
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
BESSON	08	PR D78 032012	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=52685
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABLIKIM	07H	PR D76 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52046
ABLIKIM	07J	PR D76 117101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52072
ANDREOTTI	07	PL B654 74	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (err.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
ABLIKIM	06	PL B632 181	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50986
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51037
ABLIKIM	06E	PR D73 052008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51057
ABLIKIM	06F	PR D73 052007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51058
ABLIKIM	06H	PR D73 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51125
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51127
ABLIKIM	06K	PRL 97 062001	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51128
ABLIKIM	06M	PL B639 418	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51130
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51507
ADAMS	06A	PR D73 051103	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51036
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)	REFID=51472
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABLIKIM	05B	PR D71 032003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50496
ABLIKIM	05C	PL B610 192	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50507
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05R	PRL 95 262001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50985
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
LI	05C	PR D71 111103	Z. Li <i>et al.</i>	(CLEO Collab.)	REFID=50802
SIBIRTSEV	05A	PR D71 054010	A. Sibirtsev, J. Haidenbauer		REFID=51038
ABLIKIM	04	PL B598 172	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49739
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50329
AUBERT	04	PR D69 011103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49611
AUBERT,B	04N	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
BAI	04A	PR D69 012003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49607
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04E	PL B591 42	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49751
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04H	PR D70 012005	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49754
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167
SETH	04	PR D69 097503	K.K. Seth		REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03D	PL B561 49	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49403
BAI	03F	PRL 91 022001	J.Z. Bai <i>et al.</i>	(BES II Collab.)	REFID=49473
BAI	03G	PR D68 052003	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)	REFID=49621
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	00B	PL B472 200	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47427
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98G	PL B424 213	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46341
BAI	98H	PRL 81 1179	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46342
BALDINI	98	PL B444 111	R. Baldini <i>et al.</i>	(FENICE Collab.)	REFID=46608
ARMSTRONG	96	PR D54 7067	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45146
BAI	96B	PRL 76 3502	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44736
BAI	96C	PRL 77 3959	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
BAI	96D	PR D54 1221	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45198
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 and E706 Collab.)	REFID=44739
HASAN	96	PL B388 376	A. Hasan, D.V. Bugg	(BRUN, LOQM)	REFID=45197
BAI	95B	PL B355 374	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=44434
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
ANTONELLI	93	PL B301 317	A. Antonelli <i>et al.</i>	(FENICE Collab.)	REFID=43314
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
BARNES	93	PL B309 469	P.D. Barnes <i>et al.</i>	(PS185 Collab.)	REFID=43601
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
COFFMAN	92	PRL 68 282	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41866
HSUEH	92	PR D45 2181	S. Hsueh, S. Palestini	(FNAL, TORI)	REFID=41899
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352

BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41354
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
BISELLO	90	PL B241 617	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41359
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
JOUSSET	90	PR D41 1389	J. Jousset <i>et al.</i>	(DM2 Collab.)	REFID=41349
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41004
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
AUGUSTIN	88	PRL 60 2238	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
COFFMAN	88	PR D38 2695	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=40346
FALVARD	88	PR D38 2706	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BAGLIN	87	NP B286 592	C. Baglin <i>et al.</i>	(LAPP, CERN, GENO, LYON+)	REFID=40002
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
BISELLO	87	PL B192 239	D. Bisello <i>et al.</i>	(PADO, CLER, FRAS+)	REFID=40012
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
HENNRARD	87	NP B292 670	P. Henrard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40261
PALLIN	87	NP B292 653	D. Pallin <i>et al.</i>	(CLER, FRAS, LALO, PADO)	REFID=40243
BALTRUSAIT...	86B	PR D33 1222	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22100
BALTRUSAIT...	86D	PRL 56 107	R.M. Baltrusaitis	(CIT, UCSC, ILL, SLAC+)	REFID=21865
BISELLO	86B	PL B179 294	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=22101
GAISER	86	PRL 53 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
BALTRUSAIT...	85C	PRL 55 1723	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22095
BALTRUSAIT...	85D	PR D32 566	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22097
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
EATON	84	PR D29 804	M.W. Eaton <i>et al.</i>	(LBL, SLAC)	REFID=22092
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
FRANKLIN	83	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
BURKE	82	PRL 49 632	D.L. Burke <i>et al.</i>	(LBL, SLAC)	REFID=21676
EDWARDS	82B	PR D25 3065	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22080
EDWARDS	82D	PRL 48 458	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21677
Also		ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
BESCH	81	ZPHY C8 1	H.J. Besch <i>et al.</i>	(BONN, DESY, MAINZ)	REFID=22077
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
PARTRIDGE	80	PRL 44 712	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22073
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
ALEXANDER	78	PL 72B 493	G. Alexander <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22065
BESCH	78	PL 78B 347	H.J. Besch <i>et al.</i>	(BONN, DESY, MAINZ)	REFID=22066
BRANDELIK	78B	PL 74B 292	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22067
PERUZZI	78	PR D17 2901	I. Peruzzi <i>et al.</i>	(SLAC, LBL)	REFID=22068
BARTEL	77	PL 66B 489	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22058
BURMESTER	77D	PL 72B 135	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22060
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
VANNUCCI	77	PR D15 1814	F. Vannucci <i>et al.</i>	(SLAC, LBL)	REFID=22063
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
BRAUNSCH...	76	PL 63B 487	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22054
JEAN-MARIE	76	PRL 36 291	B. Jean-Marie <i>et al.</i>	(SLAC, LBL) IG	REFID=22056
BALDINI-...	75	PL 58B 471	R. Baldini-Celio <i>et al.</i>	(FRAS, ROMA)	REFID=22026
BOYARSKI	75	PRL 34 1357	A.M. Boyarski <i>et al.</i>	(SLAC, LBL) JPC	REFID=22030
DASP	75	PL 56B 491	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22036
ESPOSITO	75B	LNC 14 73	B. Esposito <i>et al.</i>	(FRAS, NAPL, PADO+)	REFID=22038
FORD	75	PRL 34 604	R.L. Ford <i>et al.</i>	(SLAC, PENN)	REFID=22039

BRANCHING RATIOS OF $\psi(2S)$, $\chi_{c0,1,2}$ AND η_c

Updated March 2024 by J.J. Hernández-Rey (IFIC, Valencia), R. Mitchell (Indiana U.), S. Navas (U. of Granada), and C. Patrignani (Bologna Univ., INFN)

Since 2002, the treatment of the branching ratios of the $\psi(2S)$ and $\chi_{c0,1,2}$ has undergone an important restructuring. Since the 2023 online edition, the $\eta_c(1S)$ is now treated in a similar way (see the end of this note).

When measuring a branching ratio experimentally, it is not always possible to normalize the number of events observed in the corresponding decay mode to the total number of particles produced. Therefore, the experimenters sometimes report the number of observed decays with respect to another decay mode of the same or another particle in the relevant decay chain. This is actually equivalent to measuring combinations of branching fractions of several decay modes.

To extract the branching ratio of a given decay mode, the collaborations use some previously reported measurements of the required branching ratios. However, the values are frequently taken from the *Review of Particle Physics* (RPP), which in turn uses the branching ratio reported by the experiment in the following edition, giving rise either to correlations or to plain vicious circles, as discussed in more detail in earlier editions of this review [1,2].

The way to avoid these dependencies and correlations is to extract the branching ratios through a fit that uses the truly measured combinations of branching fractions and partial widths. This fit, in fact, should involve decays from the four concerned particles, $\psi(2S)$, χ_{c0} , χ_{c1} , and χ_{c2} , and occasionally some combinations of branching ratios of more than one of them. This is what is done since the 2002 edition [3].

The PDG policy is to quote the results of the collaborations in a manner as close as possible to what appears in their original publications. However, in order to avoid the problems mentioned above, we had in some cases to work out the values originally measured, using the number of events and detection efficiencies given by the collaborations, or rescaling back the published results. The information was sometimes spread over several articles, and some articles referred to papers still unpublished, which in turn contained the relevant numbers in footnotes.

Even though the experimental collaborations are entitled to extract whatever branching ratios they consider appropriate by

using other published results, we would like to encourage them to also quote explicitly in their articles the actual quantities measured, so that they can be used directly in averages and fits of different experimental determinations.

To inform the reader how we computed some of the values used in this edition of RPP, we use footnotes to indicate the branching ratios actually given by the experiments and the quantities they use to derive them from the true combination of branching ratios actually measured.

None of the branching ratios of the $\chi_{c0,1,2}$ are measured independently of the $\psi(2S)$ radiative decays. We tried to identify those branching ratios which can be correlated in a non-trivial way, and although we cannot preclude the existence of other cases, we are confident that the most relevant correlations have already been removed. Nevertheless, correlations in the errors of different quantities measured by the same experiment have not been taken into account.

The $\eta_c(1S)$ can be produced in $\gamma\gamma$ collisions, in the radiative decays of vector and axial-vector charmonia (J/ψ , $\psi(2S)$ and $h_c(1P)$) or in B meson decays. As for the $\psi(2S)$ and $\chi_{c0,1,2}$, correlations can be introduced if the derived branching ratios are not properly extracted. We now obtain the corresponding branching ratios using the products of branching ratios originally measured by the experiments, sometimes among different particles (cross-particle branching ratios) and performing an overall fit. In some cases, we were obliged to infer the original product from the information given by the collaborations. However, for recent experiments our policy is not to use anymore extracted branching ratios, so that if the original measured quantity is missing in the relevant publication, the value will not be used in our averages and fits.

1. Fit Information for the $\psi(2S)$ and $\chi_{c0,1,2}$

This is an overall fit to 4 total widths, 1 partial width, 25 combinations of partial widths, 10 branching fractions, and 76 branching ratios or combinations thereof. Of the latter, 58 involve decays of more than one particle.

The overall fit uses 253 measurements to determine 49 parameters and gives a χ^2 of 389.6 for 204 degrees of freedom. We have applied scaling factors in the final errors of the fitted values following the procedure described in section 5.2.3 of our Introduction. After rescaling, the total χ^2 is 149.6.

- ¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c0}(1P)$ fixed to the PDG 16 value.
- ² From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.
- ³ Using mass of $\psi(2S) = 3686.0$ MeV.
- ⁴ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.
- ⁵ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

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NODE=M056M;LINKAGE=EB
 NODE=M056M;LINKAGE=C
 NODE=M056M;LINKAGE=NW
 NODE=M056M;LINKAGE=D

 $\chi_{c0}(1P)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10.7±0.6 OUR FIT	Error includes scale factor of 1.1.			[10.8 ± 0.6 MeV OUR 2023 FIT]
10.5±0.8 OUR AVERAGE	Error includes scale factor of 1.1.			
10.6±1.9±2.6	5.4k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
12.6 ^{+1.5+0.9} _{-1.6-1.1}		ABLIKIM	05G	BES2 $\psi(2S) \rightarrow \gamma\chi_{c0}$
8.6 ^{+1.7} _{-1.3} ±0.1		ANDREOTTI	03	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
9.7±1.0	392	¹ BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
16.6 ^{+5.2} _{-3.7} ±0.1		AMBROGIANI	99B	E835 $\bar{p}p \rightarrow e^+e^-\gamma$
14.3±2.0±3.0		BAI	98I	BES $\psi(2S) \rightarrow \gamma\pi^+\pi^-$
13.5±3.3±4.2		GAISER	86	CBAL $\psi(2S) \rightarrow \gamma X, \gamma\pi^0\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
13.2±2.1	266	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ Recalculated by ANDREOTTI 05A.

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NODE=M056W
 NEW

NODE=M056W;LINKAGE=AN

 $\chi_{c0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(2.3 ± 0.4) %	S=2.0
Γ_2 $\rho^0\pi^+\pi^-$	(9.1 ± 3.1) × 10 ⁻³	S=1.1
Γ_3 $\rho^0\rho^0$		
Γ_4 $f_0(980)f_0(980)$	(6.7 ± 2.1) × 10 ⁻⁴	
Γ_5 $\pi^+\pi^-\pi^0\pi^0$	(3.3 ± 0.4) %	
Γ_6 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.9 ± 0.4) %	
Γ_7 $4\pi^0$	(3.3 ± 0.4) × 10 ⁻³	
Γ_8 $\pi^+\pi^-K^+K^-$	(1.82±0.16) %	S=1.2
Γ_9 $K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-$	(9.9 ^{+4.0} _{-2.8}) × 10 ⁻⁴	
Γ_{10} $K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	(8.0 ^{+2.0} _{-2.4}) × 10 ⁻⁴	
Γ_{11} $K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	(6.3 ± 1.9) × 10 ⁻³	
Γ_{12} $K_1(1400)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-$	< 2.7 × 10 ⁻³	CL=90%
Γ_{13} $f_0(980)f_0(980)$	(1.6 ^{+1.0} _{-0.9}) × 10 ⁻⁴	
Γ_{14} $f_0(980)f_0(2200)$	(7.9 ^{+2.0} _{-2.5}) × 10 ⁻⁴	
Γ_{15} $f_0(1370)f_0(1370)$	< 2.7 × 10 ⁻⁴	CL=90%
Γ_{16} $f_0(1370)f_0(1500)$	< 1.7 × 10 ⁻⁴	CL=90%
Γ_{17} $f_0(1370)f_0(1710)$	(6.7 ^{+3.5} _{-2.3}) × 10 ⁻⁴	
Γ_{18} $f_0(1500)f_0(1370)$	< 1.3 × 10 ⁻⁴	CL=90%
Γ_{19} $f_0(1500)f_0(1500)$	< 5 × 10 ⁻⁵	CL=90%
Γ_{20} $f_0(1500)f_0(1710)$	< 7 × 10 ⁻⁵	CL=90%
Γ_{21} $K^+K^-\pi^+\pi^-\pi^0$	(8.6 ± 0.9) × 10 ⁻³	
Γ_{22} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(4.2 ± 0.4) × 10 ⁻³	
Γ_{23} $K^+K^-\pi^0\pi^0$	(5.6 ± 0.9) × 10 ⁻³	
Γ_{24} $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(2.49±0.33) %	
Γ_{25} $\rho^+K^-K^0 + \text{c.c.}$	(1.21±0.21) %	

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 DESIG=3
 DESIG=9
 DESIG=54
 DESIG=20
 DESIG=61
 DESIG=62
 DESIG=70
 DESIG=5
 DESIG=31

DESIG=32

DESIG=33

DESIG=34

DESIG=23

DESIG=24

DESIG=25

DESIG=26

DESIG=27

DESIG=28

DESIG=29

DESIG=30

DESIG=75

DESIG=87

DESIG=63

DESIG=65

DESIG=66

Г26	$K^*(892)^- K^+ \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(4.6 \pm 1.2) \times 10^{-3}$		DESIG=67
Г27	$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		DESIG=41
Г28	$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Г29	$3(\pi^+ \pi^-)$	$(1.95 \pm 0.22) \%$	S=3.3	DESIG=4
Г30	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.5 \pm 1.6) \times 10^{-3}$		DESIG=10
Г31	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Г32	$\pi \pi$	$(8.5 \pm 0.4) \times 10^{-3}$	S=1.2	DESIG=18
Г33	$\pi^0 \eta$	$< 1.8 \times 10^{-4}$		DESIG=35
Г34	$\pi^0 \eta'$	$< 1.1 \times 10^{-3}$		DESIG=36
Г35	$\pi^0 \eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	DESIG=86
Г36	$\eta \eta$	$(3.01 \pm 0.25) \times 10^{-3}$	S=1.3	DESIG=13
Г37	$\eta \eta'$	$(9.1 \pm 1.1) \times 10^{-5}$		DESIG=37
Г38	$\eta' \eta'$	$(2.17 \pm 0.12) \times 10^{-3}$		DESIG=46
Г39	$\omega \omega$	$(9.7 \pm 1.1) \times 10^{-4}$		DESIG=22
Г40	$\omega \phi$	$(1.42 \pm 0.13) \times 10^{-4}$		DESIG=76
Г41	$\omega K^+ K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		DESIG=88
Г42	$K^+ K^-$	$(6.07 \pm 0.33) \times 10^{-3}$	S=1.1	DESIG=2
Г43	$K_S^0 K_S^0$	$(3.17 \pm 0.19) \times 10^{-3}$	S=1.1	DESIG=15
Г44	$\pi^+ \pi^- \eta$	$< 2.0 \times 10^{-4}$	CL=90%	DESIG=50
Г45	$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=53
Г46	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Г47	$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Г48	$K^+ K^- \eta$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=51
Г49	$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Г50	$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		DESIG=94
Г51	$K^+ K^- K^+ K^-$	$(2.8 \pm 0.4) \times 10^{-3}$	S=1.5	DESIG=14
Г52	$K^+ K^- \phi$	$(9.7 \pm 2.5) \times 10^{-4}$		DESIG=44
Г53	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		DESIG=91
Г54	$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		DESIG=92
Г55	$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		DESIG=89
Г56	$\phi \phi$	$(8.48 \pm 0.31) \times 10^{-4}$		DESIG=16
Г57	$\phi \phi \eta$	$(8.4 \pm 1.0) \times 10^{-4}$		DESIG=96
Г58	$p \bar{p}$	$(2.21 \pm 0.14) \times 10^{-4}$	S=1.6	DESIG=11
Г59	$p \bar{p} \pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.3	DESIG=48
Г60	$p \bar{p} \eta$	$(3.5 \pm 0.4) \times 10^{-4}$		DESIG=52
Г61	$p \bar{p} \omega$	$(5.3 \pm 0.6) \times 10^{-4}$		DESIG=69
Г62	$p \bar{p} \phi$	$(6.0 \pm 1.4) \times 10^{-5}$		DESIG=74
Г63	$p \bar{p} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	DESIG=8
Г64	$p \bar{p} \pi^0 \pi^0$	$(1.04 \pm 0.28) \times 10^{-3}$		DESIG=64
Г65	$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.22 \pm 0.26) \times 10^{-4}$		DESIG=71
Г66	$p \bar{p} K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	DESIG=40
Г67	$p \bar{n} \pi^-$	$(1.27 \pm 0.11) \times 10^{-3}$		DESIG=43
Г68	$\bar{p} n \pi^+$	$(1.37 \pm 0.12) \times 10^{-3}$		DESIG=82
Г69	$p \bar{n} \pi^- \pi^0$	$(2.34 \pm 0.21) \times 10^{-3}$		DESIG=83
Г70	$\bar{p} n \pi^+ \pi^0$	$(2.21 \pm 0.19) \times 10^{-3}$		DESIG=84
Г71	$\Lambda \bar{\Lambda}$	$(3.60 \pm 0.17) \times 10^{-4}$	S=1.1	DESIG=19
Г72	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.18 \pm 0.13) \times 10^{-3}$		DESIG=38
Г73	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$< 5 \times 10^{-4}$	CL=90%	DESIG=77
Г74	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=78
Г75	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=79
Г76	$\Lambda \bar{\Lambda} \eta$	$(2.3 \pm 0.4) \times 10^{-4}$		DESIG=102
Г77	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(1.25 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Г78	$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(6.7 \pm 0.5) \times 10^{-4}$		DESIG=101
Г79	$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.8 \pm 0.9) \times 10^{-4}$		DESIG=98
Г80	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-4}$		DESIG=72
Г81	$\Lambda(1520) \bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Г82	$\Sigma^0 \bar{\Sigma}^0$	$(4.69 \pm 0.32) \times 10^{-4}$		DESIG=58

Γ_{83}	$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(3.53 \pm 0.27) \times 10^{-4}$		DESIG=97
Γ_{84}	$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(3.04 \pm 0.20) \times 10^{-4}$		DESIG=100
Γ_{85}	$\Sigma^+ \bar{\Sigma}^-$	$(4.7 \pm 0.8) \times 10^{-4}$	S=2.6	DESIG=59
Γ_{86}	$\Sigma^- \bar{\Sigma}^+$	$(5.1 \pm 0.5) \times 10^{-4}$		DESIG=99
Γ_{87}	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		DESIG=80
Γ_{88}	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(2.3 \pm 0.7) \times 10^{-4}$		DESIG=81
Γ_{89}	$K^- \Lambda \Xi^+ + \text{c.c.}$	$(1.95 \pm 0.35) \times 10^{-4}$		DESIG=85
Γ_{90}	$\Xi^0 \Xi^0$	$(4.5 \pm 0.5) \times 10^{-4}$	S=1.7	DESIG=60
Γ_{91}	$\Xi^- \Xi^+$	$(4.47 \pm 0.20) \times 10^{-4}$		DESIG=39
Γ_{92}	$\Omega^- \bar{\Omega}^+$	$(3.5 \pm 0.6) \times 10^{-5}$		DESIG=103
Γ_{93}	$\eta_c \pi^+ \pi^-$	$< 7 \times 10^{-4}$	CL=90%	DESIG=90

Radiative decays

Γ_{94}	$\gamma J/\psi(1S)$	$(1.41 \pm 0.09) \%$	S=1.7	DESIG=6
Γ_{95}	$\gamma \rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Γ_{96}	$\gamma \omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Γ_{97}	$\gamma \phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Γ_{98}	$\gamma \gamma$	$(2.04 \pm 0.10) \times 10^{-4}$	S=1.1	DESIG=7
Γ_{99}	$e^+ e^- J/\psi(1S)$	$(1.34 \pm 0.30) \times 10^{-4}$		DESIG=93
Γ_{100}	$\mu^+ \mu^- J/\psi(1S)$	$< 1.9 \times 10^{-5}$	CL=90%	DESIG=95

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 86 branching ratios uses 253 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 389.6$ for 204 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_2	47									
x_8	8	4								
x_{30}	5	2	33							
x_{32}	2	1	8	3						
x_{36}	1	0	4	1	14					
x_{42}	3	1	8	3	21	12				
x_{43}	2	1	7	3	20	12	18			
x_{51}	4	2	5	2	6	4	6	6		
x_{56}	2	1	3	1	4	3	4	4	2	
x_{58}	0	0	2	1	1	1	6	6	2	1
x_{71}	1	1	8	2	26	16	23	22	6	5
x_{94}	0	0	2	0	9	5	6	5	2	1
x_{98}	-10	-5	-4	-4	17	11	14	14	0	1
Γ	-22	-10	-22	-12	-15	-7	-16	-14	-12	-7
	x_1	x_2	x_8	x_{30}	x_{32}	x_{36}	x_{42}	x_{43}	x_{51}	x_{56}
x_{71}	7									
x_{94}	-37	7								
x_{98}	4	20	8							
Γ	-3	-14	-4	-37						
	x_{58}	x_{71}	x_{94}	x_{98}						

$\chi_{c0}(1P)$ PARTIAL WIDTHS

$$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M056217

NODE=M056223

———— $\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$ ————

NODE=M056224

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 8 OUR FIT					Error includes scale factor of 1.9. [52 ± 4 eV OUR 2023 FIT]
49 ± 10 OUR AVERAGE					Error includes scale factor of 1.8.
44.7 ± 3.6 ± 4.9		3.6k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$
75 ± 13 ± 8			EISENSTEIN	01	CLE2 $e^+e^- \rightarrow e^+e^-\chi_{c0}$

NODE=M056G2
NODE=M056G2
NEW

$\Gamma(\rho^0\rho^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<12		90	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+\pi^-)$

NODE=M056G07
NODE=M056G07

$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
40 ± 4 OUR FIT					Error includes scale factor of 1.1. [40.0 ± 3.5 eV OUR 2023 FIT]
38.8 ± 3.7 ± 4.7		1.7k	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

NODE=M056G08
NODE=M056G08
NEW

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{21} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
26 ± 4 ± 4		1094	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M056G01
NODE=M056G01

$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{30} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
16 ± 4 OUR FIT					
16.7 ± 6.1 ± 3.0		495 ± 182	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

NODE=M056G09
NODE=M056G09

$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{31} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6		90	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

NODE=M056G10
NODE=M056G10

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{32} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
18.7 ± 1.5 OUR FIT					Error includes scale factor of 1.2. [18.8 ± 1.3 eV OUR 2023 FIT]
23 ± 5 OUR AVERAGE					
29.7 ^{+17.4} _{-12.0} ± 4.8		103 ⁺⁶⁰ ₋₄₂	¹ UEHARA	09	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
22.7 ± 3.2 ± 3.5		129 ± 18	² NAKAZAWA	05	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$

NODE=M056G3
NODE=M056G3
NEW

¹We multiplied the measurement by 3 to convert from $\pi^0\pi^0$ to $\pi\pi$. Interference with the continuum included.

NODE=M056G3;LINKAGE=UE

²We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056G;LINKAGE=NA

$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{36} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.4 ± 2.3 ± 1.2		22	¹ UEHARA	10A	BELL 10.6 $e^+e^- \rightarrow e^+e^-\eta\eta$

NODE=M056G06
NODE=M056G06

¹ Interference with the continuum not included.

NODE=M056G06;LINKAGE=UE

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{39} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.9		90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$

NODE=M056G02
NODE=M056G02

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G02;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{40} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.34		90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M056G03
NODE=M056G03

¹ Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G03;LINKAGE=LI

$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{42} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
13.3 ± 1.1 OUR FIT					Error includes scale factor of 1.1. [13.4 ± 1.0 eV OUR 2023 FIT]
14.3 ± 1.6 ± 2.3		153 ± 17	NAKAZAWA	05	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$

NODE=M056G4
NODE=M056G4
NEW

$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{43}\Gamma_{98}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
7.0 ± 0.6 OUR FIT	Error includes scale factor of 1.2.	[7.0 ± 0.5 eV OUR 2023 FIT]			
8.7 ± 1.7 ± 0.9	266	¹ UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.00 ± 0.65 ± 0.71	134 ± 12	CHEN	07B	BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c0}$	
¹ Supersedes CHEN 07B.					

NODE=M056G5
 NODE=M056G5
 NEW

NODE=M056G5;LINKAGE=UE

$\Gamma(K^+ K^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{51}\Gamma_{98}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
6.2 ± 1.0 OUR FIT	Error includes scale factor of 1.5.	[6.2 ± 0.7 eV OUR 2023 FIT]			
7.9 ± 1.3 ± 1.1	215 ± 36	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$	

NODE=M056G11
 NODE=M056G11
 NEW

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{56}\Gamma_{98}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.86 ± 0.13 OUR FIT	Error includes scale factor of 1.1.	[1.76 ± 0.18 eV OUR 2023 FIT]			
1.72 ± 0.33 ± 0.14	56 ± 11	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(K^+ K^-)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.3 ± 0.9 ± 0.4	23.6 ± 9.6	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+ K^-)$	
¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.					

NODE=M056G12
 NODE=M056G12
 NEW

NODE=M056G12;LINKAGE=LI

$\chi_{c0}(1P)$ BRANCHING RATIOS

NODE=M056220

HADRONIC DECAYS

NODE=M056305

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma(2(\pi^+ \pi^-))$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	COMMENT		
0.39 ± 0.12 OUR FIT					
0.39 ± 0.12	TANENBAUM	78	MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$		

NODE=M056R54
 NODE=M056R54

$\Gamma(f_0(980) f_0(980))/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
6.7 ± 2.1 OUR AVERAGE	[(6.6 ± 2.1) × 10 ⁻⁴ OUR 2023 AVERAGE]				
6.7 ± 2.1 ± 0.2	36 ± 9	¹ ABLIKIM	04G	BES $\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$	
¹ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980) f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (6.5 \pm 1.6 \pm 1.3) \times 10^{-5}]$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

NODE=M056R24
 NODE=M056R24
 NEW

NODE=M056R24;LINKAGE=AB

$\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	
3.3 ± 0.4 ± 0.1	1751.4	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$	
¹ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18 \%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					

NODE=M056R62
 NODE=M056R62

NODE=M056R62;LINKAGE=HE

$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.9 ± 0.4 ± 0.1	1358.5	^{1,2} HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$	
¹ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16 \%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² Calculated by us. We have added the values from HE 08B for $\rho^+ \pi^- \pi^0$ and $\rho^- \pi^+ \pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.					

NODE=M056R63
 NODE=M056R63

NODE=M056R63;LINKAGE=HE

NODE=M056R63;LINKAGE=OC

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.3 \pm 0.4 \pm 0.1$	3296	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R71
 NODE=M056R71

¹ ABLIKIM 11A reports $(3.34 \pm 0.06 \pm 0.44) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R71;LINKAGE=AB

 $\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma(\pi^+\pi^-K^+K^-)$ Γ_{30}/Γ_8

VALUE	DOCUMENT ID	TECN	COMMENT
0.41 ± 0.09 OUR FIT			
0.41 ± 0.10	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R55
 NODE=M056R55

 $\Gamma(K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056R36
 NODE=M056R36

$9.9^{+4.0}_{-2.8}$ OUR AVERAGE $[(9.8^{+4.0}_{-2.8}) \times 10^{-4}]$ OUR 2023 AVERAGE]

NEW

$9.9^{+3.6}_{-2.8} \pm 0.2$ 83 ¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

¹ ABLIKIM 05Q reports $(10.44 \pm 2.37^{+3.05}_{-1.90}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0\bar{K}_0^*(1430)^0 \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R36;LINKAGE=AB

 $\Gamma(K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.0^{+2.0}_{-2.4} \pm 0.2$	62	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R37
 NODE=M056R37

¹ ABLIKIM 05Q reports $(8.49 \pm 1.66^{+1.32}_{-1.99}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_0^*(1430)^0\bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R37;LINKAGE=AB

 $\Gamma(K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.3 \pm 1.9 \pm 0.1$	68	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R38
 NODE=M056R38

¹ ABLIKIM 05Q reports $(6.66 \pm 1.31^{+1.60}_{-1.51}) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1270)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The measurement assumes $B(K_1(1270) \rightarrow K\rho(770)) = 42 \pm 6\%$.

NODE=M056R38;LINKAGE=AB

 $\Gamma(K_1(1400)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R39
 NODE=M056R39

¹ ABLIKIM 05Q reports $< 2.85 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K_1(1400)^+K^- + \text{c.c.} \rightarrow \pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$. The measurement assumes $B(K_1(1400) \rightarrow K^*(892)\pi) = 94 \pm 6\%$.

NODE=M056R39;LINKAGE=AB

 $\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$16.3^{+10.5}_{-9.0} \pm 0.4$	28	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R28
 NODE=M056R28

¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(980))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (1.59 \pm 0.50^{+0.89}_{-0.72}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. One of the $f_0(980)$ mesons is identified via decay to $\pi^+\pi^-$ while the other via K^+K^- decay.

NODE=M056R28;LINKAGE=AB

$\Gamma(f_0(980)f_0(2200))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.9^{+2.0}_{-2.5} \pm 0.2$	77	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R29
NODE=M056R29

¹ ABLIKIM 05Q reports $(8.42 \pm 1.42^{+1.65}_{-2.29}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(2200))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(980) \rightarrow \pi^+\pi^-$ and $f_0(2200) \rightarrow K^+K^-$ decays.

NODE=M056R29;LINKAGE=AB

$\Gamma(f_0(1370)f_0(1370))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R30
NODE=M056R30

¹ ABLIKIM 05Q reports $< 2.9 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$. One of the $f_0(1370)$ mesons is identified via decay to $\pi^+\pi^-$ while the other via K^+K^- decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R30;LINKAGE=AB

$\Gamma(f_0(1370)f_0(1500))/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R31
NODE=M056R31

¹ ABLIKIM 05Q reports $< 1.8 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+\pi^-$ and $f_0(1500) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R31;LINKAGE=AB

$\Gamma(f_0(1370)f_0(1710))/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.7^{+3.5}_{-2.3} \pm 0.2$	61	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R32
NODE=M056R32

¹ ABLIKIM 05Q reports $(7.12 \pm 1.85^{+3.28}_{-1.68}) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1370)f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The f_0 mesons are identified via $f_0(1370) \rightarrow \pi^+\pi^-$ and $f_0(1710) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R32;LINKAGE=AB

$\Gamma(f_0(1500)f_0(1370))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R33
NODE=M056R33

¹ ABLIKIM 05Q reports $< 1.4 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500)f_0(1370))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+\pi^-$ and $f_0(1370) \rightarrow K^+K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.

NODE=M056R33;LINKAGE=AB

$\Gamma(f_0(1500) f_0(1500))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	¹ ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
¹ ABLIKIM 05Q reports $< 0.55 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1500))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$. One of the $f_0(1500)$ is identified via decay to $\pi^+ \pi^-$ while the other via $K^+ K^-$ decay. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R34
 NODE=M056R34

NODE=M056R34;LINKAGE=AB

 $\Gamma(f_0(1500) f_0(1710))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	¹ ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
¹ ABLIKIM 05Q reports $< 0.73 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(1500) f_0(1710))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$. The f_0 mesons are identified via $f_0(1500) \rightarrow \pi^+ \pi^-$ and $f_0(1710) \rightarrow K^+ K^-$ decays. Both branching fractions for these f_0 decays are implicitly included in the quoted result.				

NODE=M056R35
 NODE=M056R35

NODE=M056R35;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.61 \pm 0.13 \pm 0.94$	9.0k	¹ ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.				

NODE=M056R85
 NODE=M056R85

NODE=M056R85;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.22 \pm 0.10 \pm 0.43$	2.7k	¹ ABLIKIM	13B	BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.				

NODE=M056R86
 NODE=M056R86

NODE=M056R86;LINKAGE=A

 $\Gamma(K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.56 \pm 0.09 \pm 0.01$	213.5	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $0.59 \pm 0.05 \pm 0.08 \pm 0.03\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R64
 NODE=M056R64

NODE=M056R64;LINKAGE=HE

 $\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.49 \pm 0.33 \pm 0.06$	401.7	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $2.64 \pm 0.15 \pm 0.31 \pm 0.14\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R66
 NODE=M056R66

NODE=M056R66;LINKAGE=HE

 $\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$1.21 \pm 0.21 \pm 0.03$	179.7	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 08B reports $1.28 \pm 0.16 \pm 0.15 \pm 0.07\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R67
 NODE=M056R67

NODE=M056R67;LINKAGE=HE

 $\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.46 \pm 0.12 \pm 0.01$	64.1	¹ HE	08B	CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R68
 NODE=M056R68

¹ HE 08B reports $0.49 \pm 0.10 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R68;LINKAGE=HE

$\Gamma(K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.7 \pm 1.1 \pm 0.1$	152 ± 14	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R47
NODE=M056R47

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (0.558 \pm 0.051 \pm 0.089) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R47;LINKAGE=AB

$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$0.30 \pm 0.07 \pm 0.01$	56.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R69
NODE=M056R69

¹ HE 08B reports $0.32 \pm 0.05 \pm 0.05 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R69;LINKAGE=HE

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
19.5 ± 2.2 OUR AVERAGE		Error includes scale factor of 3.3. See the ideogram below.		

NODE=M056R4
NODE=M056R4

$[(19.6 \pm 2.1) \times 10^{-3}]$ OUR 2023 AVERAGE Scale factor = 3.3]

NEW

$20.8 \pm 0.5 \pm 0.5$	145K	¹ ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
$11.7 \pm 1.0 \pm 1.9$		² BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
$12.5 \pm 2.9 \pm 0.5$		² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c0}$

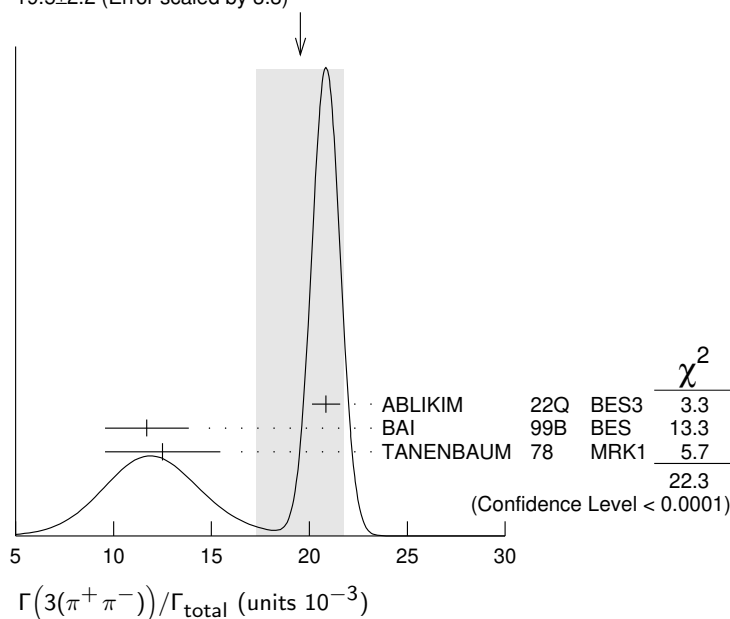
¹ ABLIKIM 22Q reports $(2.080 \pm 0.006 \pm 0.068) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow 3(\pi^+ \pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R4;LINKAGE=A

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R;LINKAGE=X1

WEIGHTED AVERAGE
 19.5 ± 2.2 (Error scaled by 3.3)



$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.72^{+0.60}_{-0.54} \pm 0.04$	64	¹ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

- $1.57 \pm 0.40 \pm 0.04$ 30 $\pm$ 6 ^{2,3} ABLIKIM 04H BES Repl. by ABLIKIM 05Q
- ¹ ABLIKIM 05Q reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(0.168 \pm 0.035^{+0.047}_{-0.040}) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.
- ³ ABLIKIM 04H reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ = $(1.53 \pm 0.29 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R26
NODE=M056R26

NODE=M056R26;LINKAGE=AI

NODE=M056R;LINKAGE=AL
NODE=M056R26;LINKAGE=AB

 $\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-3}$	90	¹ ABLIKIM	15N BES3	$\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$

¹ Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.

NODE=M056R00
NODE=M056R00

NODE=M056R00;LINKAGE=A

 $\Gamma(\eta \eta')/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$9.1 \pm 1.1 \pm 0.2$		85	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

- <24 90 35 $\pm$ 13 ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \eta' \eta$
- <50 90 ³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
- ¹ ABLIKIM 17AI reports $(8.92 \pm 0.84 \pm 0.65) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ASNER 09 reports $<0.25 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.
- ³ Superseded by ASNER 09. ADAMS 07 reports $<0.5 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R03
NODE=M056R03

NODE=M056R03;LINKAGE=A

NODE=M056R03;LINKAGE=AS

NODE=M056R03;LINKAGE=AD

 $\Gamma(\eta' \eta')/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.17 $\pm$ 0.12 OUR AVERAGE				

$2.24 \pm 0.13 \pm 0.05$	2.5k	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta'$
$2.00 \pm 0.21 \pm 0.05$	0.4k	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta' \eta'$

• • • We do not use the following data for averages, fits, limits, etc. • • •

- $1.60 \pm 0.41 \pm 0.04$ 23 ³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
- ¹ ABLIKIM 17AI reports $(2.19 \pm 0.03 \pm 0.14) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ASNER 09 reports $(2.12 \pm 0.13 \pm 0.21) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ Superseded by ASNER 09. ADAMS 07 reports $(1.7 \pm 0.4 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 0.0922 \pm 0.0011 \pm 0.0046$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R04
NODE=M056R04

NODE=M056R04;LINKAGE=A

NODE=M056R04;LINKAGE=AS

NODE=M056R04;LINKAGE=AD

$\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97±0.11 OUR AVERAGE				
0.94±0.11±0.02	991	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
2.2 ±0.7 ±0.1	38.1±9.6	² ABLIKIM	05N BES2	$\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma 6\pi$

¹ ABLIKIM 11K reports $(0.95 \pm 0.03 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 05N reports $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (0.212 \pm 0.053 \pm 0.037) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R27
NODE=M056R27

NODE=M056R27;LINKAGE=AL

NODE=M056R27;LINKAGE=AB

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.13 OUR AVERAGE				
1.42±0.13±0.03	486	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.18±0.22±0.03	76	^{2,3} ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (13.83 \pm 0.70 \pm 1.01) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 11K reports $(1.2 \pm 0.1 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by ABLIKIM 19J.

NODE=M056R76
NODE=M056R76

NEW

NODE=M056R76;LINKAGE=A

NODE=M056R76;LINKAGE=AL

NODE=M056R76;LINKAGE=B

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.94±0.06±0.20	1.4k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R87
NODE=M056R87

NODE=M056R87;LINKAGE=A

 $\Gamma(\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.20	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.0	90	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ ATHAR 07 reports $< 0.21 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

² ABLIKIM 06R reports $< 1.1 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R08
NODE=M056R08

NODE=M056R08;LINKAGE=AT

NODE=M056R08;LINKAGE=AB

 $\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $< 0.38 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R51
NODE=M056R51

NODE=M056R51;LINKAGE=AT

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.09	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.7	90	^{2,3} ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$
<0.7	90	^{3,4} BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R17
NODE=M056R17

¹ ATHAR 07 reports $< 0.10 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R17;LINKAGE=AT

² ABLIKIM 06R reports $< 0.70 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R17;LINKAGE=AB

³ We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $K^0 K^+ \pi^-$.

NODE=M056R17;LINKAGE=BA

⁴ Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R17;LINKAGE=X1

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.06	90	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M056R05
NODE=M056R05

¹ ATHAR 07 reports $< 0.06 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R05;LINKAGE=AT

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.23	90	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M056R09
NODE=M056R09

¹ ATHAR 07 reports $< 0.24 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R09;LINKAGE=AT

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.41 \pm 0.47 \pm 0.03$	16.8 ± 4.8	¹ ABLIKIM 050	BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R48
NODE=M056R48

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (0.138 \pm 0.039 \pm 0.025) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R48;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.8 \pm 0.5 \pm 0.1$	319	¹ ABLIKIM 19AA	BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$

NODE=M056R95
NODE=M056R95

¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (5.64 \pm 0.33 \pm 0.37) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M056R95;LINKAGE=A

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.97 \pm 0.25 \pm 0.02$	38	¹ ABLIKIM 06T	BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M056R01
NODE=M056R01

¹ ABLIKIM 06T reports $(1.03 \pm 0.22 \pm 0.15) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R01;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$3.68 \pm 0.30 \pm 0.50$	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R90
NODE=M056R90 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$1.90 \pm 0.14 \pm 0.32$	ABLIKIM 15M	BES3	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R91
NODE=M056R91

$\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.18±0.07±0.13	538	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R88
NODE=M056R88

NODE=M056R88;LINKAGE=A

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.848±0.031 OUR FIT				

$[(0.80 \pm 0.07) \times 10^{-3}]$ OUR 2023 FIT

0.859±0.034 OUR AVERAGE $[(0.9 \pm 0.5) \times 10^{-3}]$ OUR 2006 AVERAGE

0.859±0.027±0.020 2701 ¹ ABLIKIM 23N BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ Measured using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$ and $B(\phi \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

NODE=M056R16
NODE=M056R16
NEW

NEW

NODE=M056R16;LINKAGE=A

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.4±1.0±0.2	186.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma\phi\phi\eta$

¹ ABLIKIM 20B reports $(8.41 \pm 0.74 \pm 0.62) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R98
NODE=M056R98

NODE=M056R98;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.70±0.07 OUR AVERAGE	Error includes scale factor of 1.3. $[(0.70 \pm 0.07) \times 10^{-3}]$ OUR 2023 AVERAGE Scale factor = 1.3]		

0.73±0.06±0.02	¹ ONYISI	10	CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.56±0.12±0.01	² ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(7.76 \pm 0.37 \pm 0.51 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $(0.59 \pm 0.10 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06
NODE=M056R06

NEW

NODE=M056R06;LINKAGE=ON

NODE=M056R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.35±0.04 OUR AVERAGE			

0.35±0.04±0.01	¹ ONYISI	10	CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.37±0.11±0.01	² ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(3.73 \pm 0.38 \pm 0.28 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $(0.39 \pm 0.11 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50
NODE=M056R50

NODE=M056R50;LINKAGE=ON

NODE=M056R50;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.53±0.06 OUR AVERAGE	$[(0.52 \pm 0.06) \times 10^{-3}]$ OUR 2023 AVERAGE]		

0.53±0.06±0.01	¹ ONYISI	10	CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$

¹ ONYISI 10 reports $(5.57 \pm 0.48 \pm 0.42 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R70
NODE=M056R70

NEW

NODE=M056R70;LINKAGE=ON

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0±1.4±0.1	42 ± 8	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(6.12 \pm 1.18 \pm 0.86) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{62}/Γ

NODE=M056R75
NODE=M056R75

NODE=M056R75;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.1 ±0.7 OUR EVALUATION	Error includes scale factor of 1.4. Treating systematic error as correlated.		

2.1 ±1.0 OUR AVERAGE Error includes scale factor of 2.0.

1.57±0.21±0.53	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
4.20±1.15±0.18	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

 Γ_{63}/Γ

NODE=M056R7
NODE=M056R7

→ UNCHECKED ←

NODE=M056R7;LINKAGE=X1

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.104±0.028±0.002	39.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

¹ HE 08B reports $0.11 \pm 0.02 \pm 0.02 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{64}/Γ

NODE=M056R65
NODE=M056R65

NODE=M056R65;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.22±0.26±0.03	48 ± 8	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(1.24 \pm 0.20 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{65}/Γ

NODE=M056R72
NODE=M056R72

NODE=M056R72;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.8	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

 Γ_{66}/Γ

NODE=M056R46
NODE=M056R46

NODE=M056R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.7±1.1 OUR AVERAGE				

12.9±1.1±0.3	5150	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
11.3±3.1±0.3		² ABLIKIM	06I BES2	$\psi(2S) \rightarrow \gamma p\pi^-X$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(1.26 \pm 0.02 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 06I reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(1.10 \pm 0.24 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{67}/Γ

NODE=M056R49
NODE=M056R49

NODE=M056R49;LINKAGE=AL

NODE=M056R49;LINKAGE=AB

 $\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7±1.2±0.3	5808	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ = $(1.34 \pm 0.03 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{68}/Γ

NODE=M056R82
NODE=M056R82

NODE=M056R82;LINKAGE=AL

$\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
23.4±2.0±0.5	2480	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

NODE=M056R83
 NODE=M056R83

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (2.29 \pm 0.08 \pm 0.18) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R83;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
22.1±1.9 OUR AVERAGE				[(22.1 ± 1.8) × 10 ⁻⁴ OUR 2023 AVERAGE]
22.1±1.8±0.5	2757	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M056R84
 NODE=M056R84

NEW

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c0}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (2.16 \pm 0.07 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R84;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
118±12±3		426	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<400	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

NODE=M056R44
 NODE=M056R44

¹ ABLIKIM 12I reports $(119.0 \pm 6.4 \pm 11.4) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R44;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

NODE=M056R44;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 12I reports $< 54 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R77
 NODE=M056R77

NODE=M056R77;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$

¹ ABLIKIM 12I reports $< 55 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R78
 NODE=M056R78

NODE=M056R78;LINKAGE=AL

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<50	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$

¹ ABLIKIM 12I reports $< 50 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R79
 NODE=M056R79

NODE=M056R79;LINKAGE=AL

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.25±0.12 OUR AVERAGE				Error includes scale factor of 1.3. [(1.25 ± 0.12) × 10 ⁻³ OUR 2023 AVERAGE Scale factor = 1.3]
1.31±0.09±0.03	9k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{p}K^+$
1.01±0.19±0.02		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M056R07
 NODE=M056R07

NEW

¹ ABLIKIM 13D reports $(1.32 \pm 0.03 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07;LINKAGE=AB

² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

NODE=M056R07;LINKAGE=LB

³ ATHAR 07 reports $(1.07 \pm 0.17 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07;LINKAGE=AT

$\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{79}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.8 ± 0.9 ± 0.1	254	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$

NODE=M056R99
NODE=M056R99

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (4.7 \pm 0.7 \pm 0.5) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R99;LINKAGE=A

$\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{80}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 ± 0.8 OUR AVERAGE				$[(2.9 \pm 0.7) \times 10^{-4}]$ OUR 2023 AVERAGE]

NODE=M056R73
NODE=M056R73

NEW

3.0 ± 0.7 ± 0.1	62 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M056R73;LINKAGE=AB

¹ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$

 Γ_{78}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7 ± 0.5 OUR AVERAGE				$[(6.6 \pm 0.5) \times 10^{-4}]$ OUR 2023 AVERAGE]

NODE=M056P02
NODE=M056P02

NEW

6.7 ± 0.5 ± 0.2	1284	¹ ABLIKIM	21AV BES3	$\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$

NODE=M056P02;LINKAGE=A

¹ ABLIKIM 21AV reports $(6.65 \pm 0.26 \pm 0.41) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 0.0979 \pm 0.0020$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.

$\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$

 Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1 ± 1.2 ± 0.1	28 ± 10	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M056R74
NODE=M056R74

NODE=M056R74;LINKAGE=AB

¹ ABLIKIM 11F reports $(3.18 \pm 1.11 \pm 0.53) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$

 Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.69 ± 0.32 OUR AVERAGE				$[(4.68 \pm 0.32) \times 10^{-4}]$ OUR 2023 AVERAGE]

NODE=M056R59
NODE=M056R59

NEW

4.83 ± 0.34 ± 0.11	1046	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

4.2 ± 0.7 ± 0.1	78 ± 10	² NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.7 ± 0.5 ± 0.1	243	^{3,4} ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

- ¹ ABLIKIM 18V reports $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (4.72 \pm 0.18 \pm 0.28) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² NAIK 08 reports $(4.41 \pm 0.56 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ ABLIKIM 13H reports $(4.78 \pm 0.34 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁴ Superseded by ABLIKIM 18V

NODE=M056R59;LINKAGE=A

NODE=M056R59;LINKAGE=NA

NODE=M056R59;LINKAGE=AB

NODE=M056R59;LINKAGE=B

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

4.7 ± 0.8 OUR AVERAGE Error includes scale factor of 2.6. $[(4.6 \pm 0.8) \times 10^{-4}$ OUR 2023 AVERAGE Scale factor = 2.6]

NODE=M056R60
NODE=M056R60

NEW

5.11 ± 0.35 ± 0.12 747 ¹ ABLIKIM 18V BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

3.1 ± 0.7 ± 0.1 39 ± 7 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.5 ± 0.5 ± 0.1 148 ^{3,4} ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M056R60;LINKAGE=A

- ¹ ABLIKIM 18V reports $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (4.99 \pm 0.24 \pm 0.24) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² NAIK 08 reports $(3.25 \pm 0.57 \pm 0.43) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ ABLIKIM 13H reports $(4.54 \pm 0.42 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁴ Superseded by ABLIKIM 18V

NODE=M056R60;LINKAGE=NA

NODE=M056R60;LINKAGE=AB

NODE=M056R60;LINKAGE=B

 $\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

5.1 ± 0.5 ± 0.1 2143 ¹ ABLIKIM 20I BES3 $\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

NODE=M056P00
NODE=M056P00

NODE=M056P00;LINKAGE=A

- ¹ ABLIKIM 20I reports $(5.13 \pm 0.24 \pm 0.41) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

16.3 ± 5.8 ± 0.4 27 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R80
NODE=M056R80

NODE=M056R80;LINKAGE=AL

- ¹ ABLIKIM 12I reports $(16.4 \pm 5.7 \pm 1.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

23 ± 7 ± 1 33 ¹ ABLIKIM 12I BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M056R81
NODE=M056R81

NODE=M056R81;LINKAGE=AL

- ¹ ABLIKIM 12I reports $(23.5 \pm 6.2 \pm 2.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{89}/Γ VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT**1.95±0.35 OUR AVERAGE** $[(1.94 \pm 0.35) \times 10^{-4}]$ OUR 2023 AVERAGE]**1.95±0.35±0.05** 57 ¹ ABLIKIM 15I BES3 $\psi(2S) \rightarrow \gamma K^- \Lambda \Xi^+ + \text{c.c.}$

¹ ABLIKIM 15I reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))] = (1.90 \pm 0.30 \pm 0.16) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R92
NODE=M056R92

NEW

NODE=M056R92;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{90}/Γ VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT**4.5 ±0.5 OUR AVERAGE** Error includes scale factor of 1.7. $[(4.5 \pm 0.5) \times 10^{-4}]$ OUR 2023 AVERAGE Scale factor = 1.7]4.68±0.31±0.11 1741 ¹ ABLIKIM 220 BES3 $\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
3.2 ±0.8 ±0.1 23.3 ±4.9 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

¹ ABLIKIM 220 reports $(4.67 \pm 0.19 \pm 0.26) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² NAIK 08 reports $(3.34 \pm 0.70 \pm 0.48) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R61
NODE=M056R61

NEW

NODE=M056R61;LINKAGE=A

NODE=M056R61;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{91}/Γ VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT**4.47±0.20 OUR AVERAGE**
 $[(4.45 \pm 0.19) \times 10^{-4}]$ OUR 2023 AVERAGE]4.44±0.18±0.10 4932 ¹ ABLIKIM 220 BES3 $\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$
4.9 ±0.7 ±0.1 95 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10.3 90 ³ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c0} \gamma$

¹ ABLIKIM 220 reports $(4.43 \pm 0.08 \pm 0.18) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.2) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² NAIK 08 reports $(5.14 \pm 0.60 \pm 0.47) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45
NODE=M056R45

NEW

NODE=M056R45;LINKAGE=A

NODE=M056R45;LINKAGE=NA

NODE=M056R45;LINKAGE=AB

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT**3.51±0.54±0.29** 284 ABLIKIM 23T BES3 $\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$ NODE=M056P04
NODE=M056P04 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

< **7 × 10⁻⁴** 90 ^{1,2} ABLIKIM 13B BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<41 × 10⁻⁴ 90 ^{1,3} ABLIKIM 13B BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.

³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.

NODE=M056R89
NODE=M056R89

OCCUR=2

NODE=M056R89;LINKAGE=A

NODE=M056R89;LINKAGE=B

NODE=M056R89;LINKAGE=C

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{32}/\Gamma$$

VALUE (units 10^{-7})

DOCUMENT ID

TECN

COMMENT

18.9±1.5 OUR FIT Error includes scale factor of 1.5. $[(18.8 \pm 1.0) \times 10^{-7}$ OUR 2023 FIT]

15.3±2.4±0.8

¹ ANDREOTTI 03 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0 \pi^0$

¹ We have multiplied $B(p\bar{p}) \cdot B(\pi^0 \pi^0)$ measurement by 3 to obtain $B(p\bar{p}) \cdot B(\pi\pi)$.

NODE=M056R21
NODE=M056R21

NEW

NODE=M056R;LINKAGE=AD

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta)/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{33}/\Gamma$$

VALUE (units 10^{-7})

DOCUMENT ID

TECN

COMMENT

<0.4

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R41
NODE=M056R41

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\pi^0 \eta')/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{34}/\Gamma$$

VALUE (units 10^{-7})

DOCUMENT ID

TECN

COMMENT

<2.5

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R42
NODE=M056R42

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta)/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{36}/\Gamma$$

VALUE (units 10^{-7})

DOCUMENT ID

TECN

COMMENT

6.7±0.7 OUR FIT Error includes scale factor of 1.4. $[(6.7 \pm 0.5) \times 10^{-7}$ OUR 2023 FIT]

4.0±1.2^{+0.5}_{-0.3}

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \eta\eta$

NODE=M056R40
NODE=M056R40

NEW

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta\eta')/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{37}/\Gamma$$

VALUE (units 10^{-6})

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.1^{+2.3}_{-1.5}

ANDREOTTI 05C E835 $\bar{p}p \rightarrow \pi^0 \eta$

NODE=M056R43
NODE=M056R43

RADIATIVE DECAYS

$$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$$

$$\Gamma_{95}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 9

90

1.2 ± 4.5

¹ BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\rho^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<10

90

6 ± 12

² ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\rho^0$

¹ BENNETT 08A reports $< 9.6 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

² ABLIKIM 11E reports $< 10.5 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056310

NODE=M056R56
NODE=M056R56

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

$$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$$

$$\Gamma_{96}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 8

90

0.0 ± 2.8

¹ BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\omega$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<13

90

5 ± 11

² ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\omega$

¹ BENNETT 08A reports $< 8.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

² ABLIKIM 11E reports $< 12.9 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R57
NODE=M056R57

NODE=M056R57;LINKAGE=BE

NODE=M056R57;LINKAGE=AB

$$\Gamma(\gamma\phi)/\Gamma_{\text{total}}$$

$$\Gamma_{97}/\Gamma$$

VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

< 6

90

0.1 ± 1.6

¹ BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16

90

15 ± 7

² ABLIKIM 11E BES3 $\psi(2S) \rightarrow \gamma\gamma\phi$

¹ BENNETT 08A reports $< 6.4 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

² ABLIKIM 11E reports $< 16.2 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.77 \times 10^{-2}$.

NODE=M056R58
NODE=M056R58

NODE=M056R58;LINKAGE=BE

NODE=M056R58;LINKAGE=AB

$\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.54 \pm 0.33 \pm 0.04$	56	1,2 ABLIKIM	17I	BES3 $\psi(2S) \rightarrow \gamma e^+ e^- J/\psi$

¹ ABLIKIM 17I reports $(1.51 \pm 0.30 \pm 0.13) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow e^+ e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent from other measurements reported by ABLIKIM 17I

NODE=M056R93
NODE=M056R93

NODE=M056R93;LINKAGE=B

NODE=M056R93;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ Γ_{99}/Γ_{94}

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

$9.5 \pm 1.9 \pm 0.7$	56	1 ABLIKIM	17I	BES3 $\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

¹ Uses $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) \times B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (15.8 \pm 0.3 \pm 0.6) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M056R94
NODE=M056R94

NODE=M056R94;LINKAGE=A

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$ Γ_{100}/Γ_{99}

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

<0.14	90	<9.5	ABLIKIM	19Z	BES3 $\psi(2S) \rightarrow \gamma \chi_c \rightarrow \gamma(\mu^+ \mu^- J/\psi)$

NODE=M056R97
NODE=M056R97

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{98}/Γ_{94}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT

1.45 ± 0.13 OUR FIT	Error includes scale factor of 1.6. $[(1.45 \pm 0.08) \times 10^{-2}$ OUR 2023 FIT]		

2.0 ± 0.4 OUR AVERAGE

2.2 ± 0.4 $^{+0.1}_{-0.2}$	¹ ANDREOTTI 04	E835	$p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

1.45 ± 0.74	² AMBROGIANI 00B	E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

¹ The values of $B(p\bar{p})B(\gamma\gamma)$ and $B(\gamma\gamma)B(\gamma J/\psi)$ measured by ANDREOTTI 04 are not independent. The latter is used in the fit because of smaller systematics.

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M056R18
NODE=M056R18

NEW

NODE=M056R;LINKAGE=AN

NODE=M056R;LINKAGE=7A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{58}/\Gamma \times \Gamma_{94}/\Gamma$

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT

31.1 ± 2.2 OUR FIT	Error includes scale factor of 1.4. $[(31.1 \pm 1.5) \times 10^{-7}$ OUR 2023 FIT]			

28.2 ± 2.1 OUR AVERAGE

$28.0 \pm 1.9 \pm 1.3$	392	1,2,3 BAGNASCO	02	E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

$29.3^{+5.7}_{-4.7} \pm 1.5$	89	1,2 AMBROGIANI	99B	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

¹ Values in $(\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ and $(\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}})$ are not independent. The latter is used in the fit since it is less correlated to the total width.

² Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

³ Recalculated by ANDREOTTI 05A.

NODE=M056R19
NODE=M056R19

NEW

NODE=M056R;LINKAGE=KS

NODE=M056R19;LINKAGE=7A
NODE=M056R19;LINKAGE=AN

 $\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

 $\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}$ $\Gamma_{58}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{\psi(2S)}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

21.6 ± 1.3 OUR FIT	Error includes scale factor of 1.5. $[(21.7 \pm 0.9) \times 10^{-6}$ OUR 2023 FIT]			

23.7 ± 1.0 OUR AVERAGE

$23.7 \pm 0.8 \pm 0.9$	1222	ABLIKIM	13v	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$

$23.7 \pm 1.4 \pm 1.4$	383 ± 22	¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$

$23.6^{+3.7}_{-3.4} \pm 3.4$	89.5^{+14}_{-13}	BAI	04F	BES $\psi(2S) \rightarrow \gamma \chi_{c0}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow p\bar{p}) = (25.7 \pm 1.5 \pm 1.5 \pm 1.3) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B6
NODE=M056B6

NEW

NODE=M056B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{58}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT
6.2±0.4 OUR FIT Error includes scale factor of 1.5. [(6.25 ± 0.26) × 10⁻⁵ OUR 2023 FIT]

4.6±1.9 ¹BAI 98I BES $\psi(2S) \rightarrow \gamma\chi_{c0} \rightarrow \gamma\bar{p}p$
¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B1
 NODE=M056B1

NEW

NODE=M056B;LINKAGE=B1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{71}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
35.2±1.3 OUR FIT
35.1±1.4 OUR AVERAGE Error includes scale factor of 1.1.

35.6±1.0±1.0 1486 ABLIKIM 21L BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+$
 31.2±3.3±2.0 131 ¹NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
 • • • We do not use the following data for averages, fits, limits, etc. • • •
 32.0±1.9±2.2 369 ^{2,3}ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
¹ Calculated by us. NAIK 08 reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.8 \pm 3.6 \pm 2.2 \pm 1.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.
² Superseded by ABLIKIM 21L
³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) = (33.3 \pm 2.0 \pm 2.6) \times 10^{-5}$ from a measurement of $B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c0})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.62 \pm 0.31)\%$.

NODE=M056B20
 NODE=M056B20

NODE=M056B20;LINKAGE=NA

NODE=M056B20;LINKAGE=A
 NODE=M056B20;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{71}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
10.1±0.4 OUR FIT

13.0^{+3.6}_{-3.5}±2.5 15.2^{+4.2}_{-4.0} ¹BAI 03E BES $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$
¹ BAI 03E reports [$B(\chi_{c0} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c0}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-p) / B(J/\psi \rightarrow p\bar{p})] = (2.45^{+0.68}_{-0.65} \pm 0.46)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^-p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M056B21
 NODE=M056B21

NODE=M056B21;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{76}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
2.26±0.30±0.20 67 ABLIKIM 22AO BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+\gamma\gamma$

NODE=M056P03
 NODE=M056P03

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{94}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
0.137±0.009 OUR FIT Error includes scale factor of 1.7. [(0.138 ± 0.005) × 10⁻² OUR 2023 FIT]

0.147±0.029 OUR AVERAGE Error includes scale factor of 4.6.
 0.158±0.003±0.006 4.8k ¹ABLIKIM 17N BES3 $\psi(2S) \rightarrow \gamma\gamma J/\psi$
 0.024±0.015±0.205 12k ABLIKIM 17U BES3 $e^+e^- \rightarrow \gamma X$
 0.069±0.018 ²OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma\chi_{c0}$
 0.4 ±0.3 ³BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma\chi_{c0}$
 0.16 ±0.11 ³BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma\chi_{c0}$
 3.3 ±1.7 ⁴BIDDICK 77 CNTR $e^+e^- \rightarrow \gamma X$
 • • • We do not use the following data for averages, fits, limits, etc. • • •
 0.151±0.003±0.010 4.3k ⁵ABLIKIM 12O BES3 $\psi(2S) \rightarrow \gamma\chi_{c0}$
 0.125±0.007±0.013 560 ⁶MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma\chi_{c0}$
 0.18 ±0.01 ±0.02 ⁷ADAM 05A CLEO Repl. by MENDEZ 08

NODE=M056B2
 NODE=M056B2

NEW

NODE=M056B2;LINKAGE=A

NODE=M056B;LINKAGE=3Q
 NODE=M056B;LINKAGE=2Q
 NODE=M056B;LINKAGE=EA
 NODE=M056B2;LINKAGE=B
 NODE=M056B2;LINKAGE=ME
 NODE=M056B2;LINKAGE=AD

¹ Uses $B(J/\psi \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.
² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.
³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.
⁴ Assumes isotropic gamma distribution.
⁵ Superseded by ABLIKIM 17N.
⁶ Not independent from other measurements of MENDEZ 08.
⁷ Not independent from other values reported by ADAM 05A.

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{94}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{98}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
0.396±0.025 OUR FIT Error includes scale factor of 1.7. $[(0.397 \pm 0.015) \times 10^{-2}$ OUR 2023 FIT]

0.358±0.020±0.037 560 MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.55 ±0.04 ±0.06 172 ¹ ADAM 05A CLEO Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{98}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{98}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
2.00±0.09 OUR FIT
 $[(2.00 \pm 0.08) \times 10^{-5}$ OUR 2023 FIT]

1.95±0.09 OUR AVERAGE

1.93±0.08±0.05 3.5k ABLIKIM 17AE BES3 $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow 3\gamma$

2.17±0.32±0.10 0.2k ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow 3\gamma$

3.7 ±1.8 ±1.0 LEE 85 CBAL $\psi(2S) \rightarrow \gamma \chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.17±0.17±0.12 0.8k ¹ ABLIKIM 12A BES3 $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow 3\gamma$

¹ Superseded by ABLIKIM 17AE.

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{32}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{32}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
8.34±0.34 OUR FIT Error includes scale factor of 1.2. $[(8.34 \pm 0.29) \times 10^{-4}$ OUR 2023 FIT]

8.80±0.34 OUR AVERAGE

9.11±0.08±0.65 17k ¹ ABLIKIM 10A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

8.81±0.11±0.43 8.9k ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

8.13±0.19±0.89 2.8k ³ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (3.23 \pm 0.03 \pm 0.23 \pm 0.14) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.4 \pm 0.4)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^+ \pi^-) = (6.37 \pm 0.08 \pm 0.31 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

³ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \pi^0 \pi^0) = (2.94 \pm 0.07 \pm 0.32 \pm 0.15) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{32}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{32}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
24.0±1.0 OUR FIT Error includes scale factor of 1.2. $[(24.0 \pm 0.8) \times 10^{-4}$ OUR 2023 FIT]

20.7±1.7 OUR AVERAGE

23.9±2.7±4.1 97 ± 11 ¹ BAI 03C BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^0 \pi^0$

20.2±1.1±1.5 720 ± 32 ² BAI 98I BES $\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \pi^+ \pi^-$

¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi \pi$.

² Calculated by us. The value for $B(\chi_{c0} \rightarrow \pi^+ \pi^-)$ reported in BAI 98I is derived using $B(\psi' \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi' \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi \pi$.

NODE=M056B8
 NODE=M056B8

NEW

NODE=M056B;LINKAGE=AD

NODE=M056B3
 NODE=M056B3

NEW

NODE=M056B3;LINKAGE=A

NODE=M056B22
 NODE=M056B22

NEW

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

NODE=M056B5
 NODE=M056B5

NEW

NODE=M056B;LINKAGE=D1

NODE=M056B;LINKAGE=D2

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{36}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.94±0.22 OUR FIT Error includes scale factor of 1.2. [(2.95 ± 0.18) × 10⁻⁴ OUR 2023 FIT]

3.12±0.19 OUR AVERAGE

3.23±0.09±0.23 2132 ¹ ABLIKIM 10A BES3 e⁺e⁻ → ψ(2S) → γχ_{c0}
 2.93±0.12±0.29 0.9k ² ASNER 09 CLEO ψ(2S) → γηη

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.86±0.46±0.37 48 ³ ADAMS 07 CLEO ψ(2S) → γχ_{c0}

¹ Calculated by us. ABLIKIM 10A reports B(χ_{c0} → ηη) = (3.44 ± 0.10 ± 0.24 ± 0.13) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.4 ± 0.4)%.

² Calculated by us. ASNER 09 reports B(χ_{c0} → ηη) = (3.18 ± 0.13 ± 0.31 ± 0.16) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

³ Superseded by ASNER 09. Calculated by us. The value of B(χ_{c0}(1P) → ηη) reported by ADAMS 07 was derived using B(ψ(2S) → γχ_{c0}(1P)) = (9.22 ± 0.11 ± 0.46)% (ATHAR 04).

NODE=M056B11
 NODE=M056B11

NEW

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

$$\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{36}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

0.85 ±0.06 OUR FIT Error includes scale factor of 1.2. [(0.85 ± 0.05) × 10⁻³ OUR 2023 FIT]

0.578±0.241±0.158 BAI 03C BES ψ(2S) → γηη

NODE=M056B10
 NODE=M056B10

NEW

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{42}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

5.93±0.28 OUR FIT [(5.92 ± 0.28) × 10⁻⁴ OUR 2023 FIT]

5.97±0.07±0.32 8.1k ¹ ASNER 09 CLEO ψ(2S) → γK⁺K⁻

¹ Calculated by us. ASNER 09 reports B(χ_{c0} → K⁺K⁻) = (6.47 ± 0.08 ± 0.35 ± 0.32) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

NODE=M056B23
 NODE=M056B23

NEW

NODE=M056B23;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{42}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

1.71±0.08 OUR FIT

1.63±0.10±0.15 774 ± 38 ¹ BAI 98I BES ψ(2S) → γK⁺K⁻

¹ Calculated by us. The value for B(χ_{c0} → K⁺K⁻) reported by BAI 98I is derived using B(ψ(2S) → γχ_{c0}) = (9.3 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B9
 NODE=M056B9

NODE=M056B9;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{43}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma^{\psi(2S)}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

3.10±0.16 OUR FIT [(3.10 ± 0.16) × 10⁻⁴ OUR 2023 FIT]

3.18±0.17 OUR AVERAGE

3.22±0.07±0.17 2.1k ¹ ASNER 09 CLEO ψ(2S) → γK_S⁰K_S⁰

3.02±0.19±0.33 322 ABLIKIM 05O BES2 ψ(2S) → γK_S⁰K_S⁰

¹ Calculated by us. ASNER 09 reports B(χ_{c0} → K_S⁰K_S⁰) = (3.49 ± 0.08 ± 0.18 ± 0.17) × 10⁻³ using B(ψ(2S) → γχ_{c0}) = (9.22 ± 0.11 ± 0.46)%.

NODE=M056B12
 NODE=M056B12

NEW

NODE=M056B12;LINKAGE=AS

$$\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{43}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

8.9±0.5 OUR FIT [(8.9 ± 0.5) × 10⁻⁴ OUR 2023 FIT]

5.6±0.8±1.3 ¹ BAI 99B BES ψ(2S) → γK_S⁰K_S⁰

¹ Calculated by us. The value of B(χ_{c0} → K_S⁰K_S⁰) reported by BAI 99B was derived using B(ψ(2S) → γχ_{c0}(1P)) = (9.3 ± 0.8)% and B(ψ(2S) → J/ψπ⁺π⁻) = (32.4 ± 2.6)% [BAI 98D].

NODE=M056B13
 NODE=M056B13

NEW

NODE=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_1 / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

1.78 ± 1.0 OUR FIT Error includes scale factor of 2.0. $[(6.6 \pm 0.5) \times 10^{-3}$ OUR 2023 FIT]

6.9 ± 2.4 OUR AVERAGE Error includes scale factor of 3.8.

4.4 ± 0.1 ± 0.9 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$

9.3 ± 0.9 ² TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98b].

² The value $B(\psi(1S) \rightarrow \gamma \chi_{c0}) \times B(\chi_{c0} \rightarrow 2\pi^+ 2\pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B4
NODE=M056B4

NEW

NODE=M056B;LINKAGE=B2

NODE=M056B;LINKAGE=J1

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}}{\Gamma_8 / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

1.78 ± 0.15 OUR FIT Error includes scale factor of 1.1. $[(1.78 \pm 0.14) \times 10^{-3}$ OUR 2023 FIT]

1.64 ± 0.05 ± 0.2 ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056B18
NODE=M056B18

NEW

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_8 / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

5.1 ± 0.4 OUR FIT Error includes scale factor of 1.1. $[(5.1 \pm 0.4) \times 10^{-3}$ OUR 2023 FIT]

5.8 ± 1.6 OUR AVERAGE Error includes scale factor of 2.3.

4.22 ± 0.20 ± 0.97 BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c0}$

7.4 ± 1.0 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c0}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M056B19
NODE=M056B19

NEW

NODE=M056B19;LINKAGE=TA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}}{\Gamma_{51} / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.8 ± 0.4 OUR FIT Error includes scale factor of 1.5. $[(2.76 \pm 0.28) \times 10^{-4}$ OUR 2023 FIT]

3.20 ± 0.11 ± 0.41 278 ¹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B14
NODE=M056B14

NEW

NODE=M056B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{51} / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

8.0 ± 1.2 OUR FIT Error includes scale factor of 1.5. $[(8.0 \pm 0.8) \times 10^{-4}$ OUR 2023 FIT]

6.1 ± 0.8 ± 0.9 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98b].

NODE=M056B15
NODE=M056B15

NEW

NODE=M056B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}}{\Gamma_{56} / \Gamma \times \Gamma_{179}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

0.829 ± 0.034 OUR FIT $[(0.78 \pm 0.07) \times 10^{-4}$ OUR 2023 FIT]

0.78 ± 0.08 OUR AVERAGE

0.77 ± 0.03 ± 0.08 612 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

0.86 ± 0.19 ± 0.12 26 ² ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

² Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.2 \pm 0.4)\%$.

NODE=M056B16
NODE=M056B16

NEW

NODE=M056B16;LINKAGE=AL

NODE=M056B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{56}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.39±0.10 OUR FIT[(2.25 ± 0.21) × 10⁻⁴ OUR 2023 FIT]**2.6 ± 1.0 ± 1.1**¹ BAI

99B BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi\phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98d].

NODE=M056B17

NODE=M056B17

NEW

NODE=M056B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{83}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.45±0.17±0.19

493

¹ ABLIKIM

19BB BES3

 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_c^0 \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (3.52 \pm 0.19 \pm 0.21) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.79 \pm 0.20)\%$ and other branching fractions from PDG 18.

NODE=M056B24

NODE=M056B24

NODE=M056B24;LINKAGE=A

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))/\Gamma_{\text{total}}}{\Gamma_{84}/\Gamma \times \Gamma_{179}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

2.97±0.12±0.14

871

¹ ABLIKIM

20AE BES3

 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_c^0 \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (3.03 \pm 0.12 \pm 0.15) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_c^0) = (9.79 \pm 0.20)\%$ and other branching fractions from PDG 20.

NODE=M056P01

NODE=M056P01

NODE=M056P01;LINKAGE=A

$\chi_{c0}(1P)$ REFERENCES

ABLIKIM	23N	JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM	23T	PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
ABLIKIM	22AO	PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM	22O	JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AV	JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026
ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310
ABLIKIM	17AI	PR D96 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58321
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56779
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54266
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
ABLIKIM	10A	PR D81 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53347
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52721
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761

NODE=M056

BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ABLIKIM	05Q	PR D72 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50958
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ANDREOTTI	05C	PR D72 112002	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50991
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ANDREOTTI	04	PL B584 16	M. Andreotti <i>et al.</i>	(E835 Collab.)	REFID=49744
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
ANDREOTTI	03	PRL 91 091801	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=49578
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
BAGNASCO	02	PL B533 237	S. Bagnasco <i>et al.</i>	(FNAL E835 Collab.)	REFID=48833
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
AMBROGIANI	99B	PRL 83 2902	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47389
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059

$\chi_{c1}(1P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the Review on "Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ " before the $\chi_{c0}(1P)$ Listings.

NODE=M055

NODE=M055

 $\chi_{c1}(1P)$ MASS

NODE=M055M

NODE=M055M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.67 $\pm$ 0.05 OUR AVERAGE		Error includes scale factor of 1.2.		
3509.84 $\pm$ 0.69 $\pm$ 0.64	2.8k	AAIJ	23AH LHCb	$B^+ \rightarrow K^+ (K_S^0 K \pi)$
3508.4 $\pm$ 1.9 $\pm$ 0.7	460	¹ AAIJ	17BB LHCb	$p p \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$
3510.71 $\pm$ 0.04 $\pm$ 0.09	4.8k	² AAIJ	17BI LHCb	$\chi_{c1} \rightarrow J/\psi \mu^+ \mu^-$
3510.30 $\pm$ 0.14 $\pm$ 0.16		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3510.719 $\pm$ 0.051 $\pm$ 0.019		ANDREOTTI	05A E835	$p \bar{p} \rightarrow e^+ e^- \gamma$
3509.4 $\pm$ 0.9		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3510.60 $\pm$ 0.087 $\pm$ 0.019	513	³ ARMSTRONG	92 E760	$\bar{p} p \rightarrow e^+ e^- \gamma$
3511.3 $\pm$ 0.4 $\pm$ 0.4	30	BAGLIN	86B SPEC	$\bar{p} p \rightarrow e^+ e^- X$
3512.3 $\pm$ 0.3 $\pm$ 4.0		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 $\pm$ 1.7	91	⁵ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- \text{A}$
3510.4 $\pm$ 0.6		OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3510.1 $\pm$ 1.1	254	⁶ HIMEL	80 MRK2	$e^+ e^- \rightarrow J/\psi 2\gamma$
3509 $\pm$ 11	21	BRANDELIK	79B DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
3507 $\pm$ 3		⁶ BARTEL	78B CNTR	$e^+ e^- \rightarrow J/\psi 2\gamma$
3505.0 $\pm$ 4 $\pm$ 4		^{6,7} TANENBAUM	78 MRK1	$e^+ e^-$
3513 $\pm$ 7	367	⁶ BIDDICK	77 CNTR	$\psi(2S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3500 $\pm$ 10	40	TANENBAUM	75 MRK1	Hadrons γ

OCCUR=2

- ¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c1}(1P)$ fixed to the PDG 16 value.
² AAIJ 17BI reports also $m(\chi_{c2}) - m(\chi_{c1}) = 45.39 \pm 0.07 \pm 0.03$ MeV.
³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.
⁴ Using mass of $\psi(2S) = 3686.0$ MeV.
⁵ $J/\psi(1S)$ mass constrained to 3097 MeV.
⁶ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.
⁷ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M055M;LINKAGE=A

NODE=M055M;LINKAGE=B
 NODE=M055M;LINKAGE=NW
 NODE=M055M;LINKAGE=C
 NODE=M055M;LINKAGE=P
 NODE=M055M;LINKAGE=D

NODE=M055M;LINKAGE=M

 $\chi_{c1}(1P)$ WIDTH

NODE=M055W

NODE=M055W
 NEW

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 $\pm$ 0.04 OUR FIT			Error includes scale factor of 1.1. [0.84 $\pm$ 0.04 MeV OUR 2023 FIT]		
0.88 $\pm$ 0.05 OUR AVERAGE					
1.39 $^{+0.40}_{-0.38}$ $^{+0.26}_{-0.77}$			ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
0.876 $\pm$ 0.045 $\pm$ 0.026			ANDREOTTI	05A E835	$p \bar{p} \rightarrow e^+ e^- \gamma$
0.87 $\pm$ 0.11 $\pm$ 0.08		513	¹ ARMSTRONG	92 E760	$\bar{p} p \rightarrow e^+ e^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.3		95	BAGLIN	86B SPEC	$\bar{p} p \rightarrow e^+ e^- X$
<3.8		90	GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

- ¹ Recalculated by ANDREOTTI 05A.

NODE=M055W;LINKAGE=AN

 $\chi_{c1}(1P)$ DECAY MODES

NODE=M055215;NODE=M055

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 hadrons		
Γ_2 $e^+ e^-$	(1.4 $^{+1.5}_{-1.0}$) $\times 10^{-7}$	

DESIG=112

DESIG=110

Hadronic decays

NODE=M055;CLUMP=A

Γ_3	$3(\pi^+\pi^-)$	$(1.04 \pm 0.16) \%$	S=4.6	DESIG=6
Γ_4	$2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		DESIG=5
Γ_5	$\pi^+\pi^-\pi^0\pi^0$	$(1.19 \pm 0.15) \%$		DESIG=51
Γ_6	$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.45 \pm 0.24) \%$		DESIG=52
Γ_7	$\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		DESIG=9
Γ_8	$4\pi^0$	$(5.4 \pm 0.8) \times 10^{-4}$		DESIG=60
Γ_9	$\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		DESIG=7
Γ_{10}	$K^+K^-\pi^0\pi^0$	$(1.12 \pm 0.27) \times 10^{-3}$		DESIG=53
Γ_{11}	$K^+K^-\pi^+\pi^-\pi^0$	$(1.15 \pm 0.13) \%$		DESIG=79
Γ_{12}	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(7.5 \pm 0.8) \times 10^{-3}$		DESIG=84
Γ_{13}	$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(8.6 \pm 1.4) \times 10^{-3}$		DESIG=55
Γ_{14}	$\rho^-K^+\bar{K}^0 + \text{c.c.}$	$(5.0 \pm 1.2) \times 10^{-3}$		DESIG=56
Γ_{15}	$K^*(892)^0\bar{K}^0\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=57
Γ_{16}	$K^+K^-\eta\pi^0$	$(1.12 \pm 0.34) \times 10^{-3}$		DESIG=58
Γ_{17}	$\pi^+\pi^-K_S^0K_S^0$	$(6.9 \pm 2.9) \times 10^{-4}$		DESIG=28
Γ_{18}	$K^+K^-\eta$	$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=42
Γ_{19}	$\bar{K}^0K^+\pi^- + \text{c.c.}$	$(7.0 \pm 0.6) \times 10^{-3}$	S=1.1	DESIG=17
Γ_{20}	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(1.03 \pm 0.15) \times 10^{-3}$		DESIG=32
Γ_{21}	$K^*(892)^+K^- + \text{c.c.}$	$(1.21 \pm 0.23) \times 10^{-3}$		DESIG=33
Γ_{22}	$K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%	DESIG=34
Γ_{23}	$K_J^*(1430)^+K^- + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.}$	$< 2.1 \times 10^{-3}$	CL=90%	DESIG=35
Γ_{24}	$K^+K^-\pi^0$	$(1.81 \pm 0.24) \times 10^{-3}$		DESIG=38
Γ_{25}	$\eta\pi^+\pi^-$	$(4.62 \pm 0.24) \times 10^{-3}$		DESIG=31
Γ_{26}	$a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(3.2 \pm 0.4) \times 10^{-3}$	S=2.1	DESIG=36
Γ_{27}	$a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(1.76 \pm 0.24) \times 10^{-4}$		DESIG=93
Γ_{28}	$a_2(1700)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(4.6 \pm 0.7) \times 10^{-5}$		DESIG=96
Γ_{29}	$f_2(1270)\eta \rightarrow \eta\pi^+\pi^-$	$(3.5 \pm 0.6) \times 10^{-4}$		DESIG=94
Γ_{30}	$f_4(2050)\eta \rightarrow \eta\pi^+\pi^-$	$(2.5 \pm 0.9) \times 10^{-5}$		DESIG=95
Γ_{31}	$\pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 5 \times 10^{-5}$	CL=90%	DESIG=97
Γ_{32}	$\pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=98
Γ_{33}	$\pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 8 \times 10^{-6}$	CL=90%	DESIG=99
Γ_{34}	$f_2(1270)\eta$	$(6.7 \pm 1.1) \times 10^{-4}$		DESIG=37
Γ_{35}	$\pi^+\pi^-\eta'$	$(2.2 \pm 0.4) \times 10^{-3}$		DESIG=44
Γ_{36}	$K^+K^-\eta'(958)$	$(8.8 \pm 0.9) \times 10^{-4}$		DESIG=85
Γ_{37}	$K_0^*(1430)^+K^- + \text{c.c.}$	$(6.4 \pm_{-2.8}^{+2.2}) \times 10^{-4}$		DESIG=86
Γ_{38}	$f_0(980)\eta'(958)$	$(1.6 \pm_{-0.7}^{+1.4}) \times 10^{-4}$		DESIG=87
Γ_{39}	$f_0(1710)\eta'(958)$	$(7 \pm_{-5}^{+7}) \times 10^{-5}$		DESIG=88
Γ_{40}	$f_2'(1525)\eta'(958)$	$(9 \pm 6) \times 10^{-5}$		DESIG=89
Γ_{41}	$K_2^*(1430)^+K^- + \text{c.c.}$	$(1.61 \pm 0.31) \times 10^{-3}$		DESIG=115
Γ_{42}	$K_2^*(1430)\bar{K}^0 + \text{c.c.}$	$(1.17 \pm 0.20) \times 10^{-3}$		DESIG=116
Γ_{43}	$\pi^0 f_0(980) \rightarrow \pi^0\pi^+\pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$		DESIG=61
Γ_{44}	$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		DESIG=10
Γ_{45}	$K^*(892)^0\bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$		DESIG=21
Γ_{46}	$K^+K^-K_S^0K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=29
Γ_{47}	$K_S^0K_S^0K_S^0K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$		DESIG=102
Γ_{48}	$K^+K^-K^+K^-$	$(5.4 \pm 1.1) \times 10^{-4}$		DESIG=14
Γ_{49}	$K^+K^-\phi$	$(4.1 \pm 1.5) \times 10^{-4}$		DESIG=30
Γ_{50}	$\bar{K}^0K^+\pi^-\phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		DESIG=90
Γ_{51}	$K^+K^-\pi^0\phi$	$(1.62 \pm 0.30) \times 10^{-3}$		DESIG=91
Γ_{52}	$\phi\pi^+\pi^-\pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		DESIG=82
Γ_{53}	$\omega\omega$	$(5.7 \pm 0.7) \times 10^{-4}$		DESIG=66
Γ_{54}	ωK^+K^-	$(7.8 \pm 0.9) \times 10^{-4}$		DESIG=81

「55	$\omega\phi$	$(2.7 \pm 0.4) \times 10^{-5}$		DESIG=67
「56	$\phi\phi$	$(4.26 \pm 0.21) \times 10^{-4}$		DESIG=68
「57	$\phi\phi\eta$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=104
「58	$p\bar{p}$	$(7.6 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=11
「59	$p\bar{p}\pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$		DESIG=39
「60	$p\bar{p}\eta$	$(1.45 \pm 0.25) \times 10^{-4}$		DESIG=43
「61	$p\bar{p}\omega$	$(2.12 \pm 0.31) \times 10^{-4}$		DESIG=59
「62	$p\bar{p}\phi$	$< 1.7 \times 10^{-5}$	CL=90%	DESIG=65
「63	$p\bar{p}\pi^+\pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		DESIG=8
「64	$p\bar{p}\pi^0\pi^0$	$< 5 \times 10^{-4}$	CL=90%	DESIG=54
「65	$p\bar{p}K^+K^-$ (non-resonant)	$(1.27 \pm 0.22) \times 10^{-4}$		DESIG=62
「66	$p\bar{p}K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
「67	$p\bar{n}\pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=74
「68	$\bar{p}n\pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=75
「69	$p\bar{n}\pi^-\pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		DESIG=76
「70	$\bar{p}n\pi^+\pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$		DESIG=77
「71	$\Lambda\bar{\Lambda}$	$(1.27 \pm 0.09) \times 10^{-4}$	S=1.1	DESIG=19
「72	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		DESIG=24
「73	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=69
「74	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=70
「75	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=71
「76	$\Lambda\bar{\Lambda}\eta$	$(5.9 \pm 1.5) \times 10^{-5}$		DESIG=111
「77	$K^+\bar{p}\Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2	DESIG=40
「78	$nK_S^0\bar{\Lambda} + \text{c.c.}$	$(1.66 \pm 0.17) \times 10^{-4}$		DESIG=109
「79	$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		DESIG=106
「80	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		DESIG=63
「81	$\Lambda(1520)\bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%	DESIG=64
「82	$\Sigma^0\bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$		DESIG=48
「83	$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(1.53 \pm 0.12) \times 10^{-4}$		DESIG=105
「84	$\Sigma^0\bar{p}K^+ + \text{c.c.}$	$(1.46 \pm 0.10) \times 10^{-4}$		DESIG=108
「85	$\Sigma^+\bar{\Sigma}^-$	$(3.6 \pm 0.7) \times 10^{-5}$		DESIG=49
「86	$\Sigma^-\bar{\Sigma}^+$	$(5.7 \pm 1.5) \times 10^{-5}$		DESIG=107
「87	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%	DESIG=72
「88	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	DESIG=73
「89	$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(1.35 \pm 0.24) \times 10^{-4}$		DESIG=92
「90	$\Xi^0\bar{\Xi}^0$	$(7.5 \pm 1.3) \times 10^{-5}$		DESIG=50
「91	$\Xi^-\bar{\Xi}^+$	$(6.0 \pm 0.6) \times 10^{-5}$		DESIG=26
「92	$\Omega^-\bar{\Omega}^+$	$(1.49 \pm 0.25) \times 10^{-5}$		DESIG=113
「93	$\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$		DESIG=23
「94	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=27
「95	$\eta_c\pi^+\pi^-$	$< 3.2 \times 10^{-3}$	CL=90%	DESIG=83

Radiative decays

「96	$\gamma J/\psi(1S)$	$(34.3 \pm 1.3) \%$	S=1.3	NODE=M055;CLUMP=B DESIG=1
「97	$\gamma\rho^0$	$(2.16 \pm 0.17) \times 10^{-4}$		DESIG=45
「98	$\gamma\omega$	$(6.8 \pm 0.8) \times 10^{-5}$		DESIG=46
「99	$\gamma\phi$	$(2.4 \pm 0.5) \times 10^{-5}$		DESIG=47
「100	$\gamma\gamma$	$< 6.3 \times 10^{-6}$	CL=90%	DESIG=4
「101	$e^+e^- J/\psi(1S)$	$(3.46 \pm 0.24) \times 10^{-3}$		DESIG=100
「102	$\mu^+\mu^- J/\psi(1S)$	$(2.33 \pm 0.29) \times 10^{-4}$		DESIG=103

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 86 branching ratios uses 253 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 389.6$ for 204 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{48}	4				
x_{58}	-1	0			
x_{71}	12	5	-1		
x_{96}	20	9	-25	23	
Γ	-9	-4	-60	-11	-31
	x_{19}	x_{48}	x_{58}	x_{71}	x_{96}

$\chi_{c1}(1P)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$					Γ_2
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.12^{+0.13}_{-0.08}$	250	¹ ABLIKIM	22AF BES3	$e^+e^- \rightarrow \chi_{c1} \rightarrow \gamma J/\psi$	
¹ Assuming $\Gamma(\chi_{c1} \rightarrow \gamma J/\psi) = 0.28$ MeV.					

NODE=M055220

NODE=M055W1
NODE=M055W1

NODE=M055W1;LINKAGE=A

$\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$

$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$					$\Gamma_{58} \Gamma_{96} / \Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT		
21.9 ± 0.8 OUR FIT					
[21.9 ± 0.8 eV OUR 2023 FIT]					
21.4 ± 0.9 OUR AVERAGE					
$21.5 \pm 0.5 \pm 0.8$	¹ ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$		
$21.4 \pm 1.5 \pm 2.2$	^{1,2} ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$		
$19.9^{+4.4}_{-4.0}$	¹ BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$		

NODE=M055223

NODE=M055G1
NODE=M055G1
NEW¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.² Recalculated by ANDREOTTI 05A.NODE=M055G;LINKAGE=7A
NODE=M055G;LINKAGE=AN

$\chi_{c1}(1P)$ BRANCHING RATIOS

NODE=M055225

HADRONIC DECAYS

NODE=M055305

$\Gamma(3(\pi^+\pi^-)) / \Gamma_{\text{total}}$					Γ_3 / Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
10.4 ± 1.6 OUR AVERAGE					
Error includes scale factor of 4.6. [(10.5 ± 1.5) $\times 10^{-3}$]					
OUR 2023 AVERAGE Scale factor = 4.6]					
$10.92 \pm 0.23 \pm 0.30$	84K	¹ ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+\pi^-)$	
$5.4 \pm 0.7 \pm 0.9$		² BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c1}$	
$16.0 \pm 5.9 \pm 0.8$		² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$	

NODE=M055R6
NODE=M055R6

NEW

¹ ABLIKIM 22Q reports $(1.092 \pm 0.004 \pm 0.035) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 3(\pi^+\pi^-)) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R6;LINKAGE=A

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R;LINKAGE=X2

$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

7.6±2.6 OUR EVALUATION Treating systematic error as correlated.**8 ±4 OUR AVERAGE** Error includes scale factor of 1.5.4.6±2.1±2.6 ¹BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$ 12.5±4.2±0.6 ¹TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$ ¹Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.NODE=M055R4
NODE=M055R4

→ UNCHECKED ←

NODE=M055R4;LINKAGE=X2

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.19±0.15±0.03 604.7 ¹HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0$ ¹HE 08B reports $1.28 \pm 0.06 \pm 0.15 \pm 0.08\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R35
NODE=M055R35

NODE=M055R35;LINKAGE=HE

 $\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.45±0.24±0.04 712.3 ^{1,2}HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0$ ¹HE 08B reports $1.56 \pm 0.13 \pm 0.22 \pm 0.10\%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.²Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.NODE=M055R36
NODE=M055R36

NODE=M055R36;LINKAGE=HE

NODE=M055R36;LINKAGE=OC

 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

3.9±3.5 ¹TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$ ¹Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.NODE=M055R8
NODE=M055R8

NODE=M055R;LINKAGE=T

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

5.4±0.8±0.1 608 ¹ABLIKIM 11A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$ ¹ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R44
NODE=M055R44

NODE=M055R44;LINKAGE=AB

 $\Gamma(\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

4.5±1.0 OUR EVALUATION Treating systematic error as correlated.**4.5±0.9 OUR AVERAGE**4.2±0.4±0.9 ¹BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$ 7.3±3.0±0.4 ¹TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$ ¹Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.NODE=M055R5
NODE=M055R5

→ UNCHECKED ←

NODE=M055R5;LINKAGE=X2

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.12±0.27±0.03 45.1 ¹HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0$ ¹HE 08B reports $(0.12 \pm 0.02 \pm 0.02 \pm 0.01) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M055R37
NODE=M055R37

NODE=M055R37;LINKAGE=HE

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.46±0.12±1.29	12k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R00
NODE=M055R00

NODE=M055R00;LINKAGE=A

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.52±0.11±0.79	5.1k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R60
NODE=M055R60

NODE=M055R60;LINKAGE=A

$$\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.86±0.13±0.02	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R39
NODE=M055R39

NODE=M055R39;LINKAGE=HE

$$\Gamma(\rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.50±0.12±0.01	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R40
NODE=M055R40

NODE=M055R40;LINKAGE=HE

$$\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.23±0.06±0.01	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R41
NODE=M055R41

NODE=M055R41;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.112±0.034±0.003	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.12 \pm 0.03 \pm 0.02 \pm 0.01 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R42
NODE=M055R42

NODE=M055R42;LINKAGE=HE

$$\Gamma(\pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.9±2.9±0.2	19.8±7.7	¹ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

¹ ABLIKIM 05o reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $= (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05
NODE=M055R05

NODE=M055R05;LINKAGE=AB

$$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.2±1.0±0.1	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.34 \pm 0.10 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R25
NODE=M055R25

NODE=M055R25;LINKAGE=AT

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.03±0.15 OUR AVERAGE[(1.0 ± 0.4) × 10⁻³ OUR 2023 AVERAGE]

1.04±0.13±0.10	262	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
0.98±0.37±0.03	22	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ AAIJ 23AH reports $(1.04 \pm 0.13 \pm 0.04 \pm 0.09) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

² ABLIKIM 06R reports $(1.1 \pm 0.4 \pm 0.1) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R09
 NODE=M055R09
 NEW

NODE=M055R09;LINKAGE=B

NODE=M055R09;LINKAGE=AB

 $\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.21±0.23 OUR AVERAGE[(1.4 ± 0.6) × 10⁻³ OUR 2023 AVERAGE]

1.18±0.17±0.17	288	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
1.43±0.65±0.04	27	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ AAIJ 23AH reports $(1.18 \pm 0.17 \pm 0.14 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

² ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R10
 NODE=M055R10
 NEW

NODE=M055R10;LINKAGE=C

NODE=M055R10;LINKAGE=AB

 $\Gamma(K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<8 × 10⁻⁴ 90 ¹ ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R12
 NODE=M055R12

NODE=M055R12;LINKAGE=AB

 $\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.1 × 10⁻³ 90 ¹ ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R13
 NODE=M055R13

NODE=M055R13;LINKAGE=AB

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

1.81±0.24±0.05 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(1.95 \pm 0.16 \pm 0.23) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R20
 NODE=M055R20

NODE=M055R20;LINKAGE=AT

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

4.62±0.24 OUR AVERAGE[(4.62 ± 0.23) × 10⁻³ OUR 2023 AVERAGE]

4.58±0.23±0.13		^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
4.7 ± 0.5 ± 0.1		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
5.3 ± 0.9 ± 0.1	222	⁴ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R08
 NODE=M055R08
 NEW

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.67 \pm 0.03 \pm 0.23 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ATHAR 07 reports $(5.0 \pm 0.3 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ ABLIKIM 06R reports $(5.9 \pm 0.7 \pm 0.8) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=A
NODE=M055R08;LINKAGE=B

NODE=M055R08;LINKAGE=AT

NODE=M055R08;LINKAGE=AB

$\Gamma(a_0(980)^+\pi^-\text{+c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2 ± 0.4 OUR AVERAGE		Error includes scale factor of 2.1. $[(3.2 \pm 0.4) \times 10^{-3} \text{ OUR 2023 AVERAGE Scale factor} = 2.2]$		
3.33 ± 0.19 ± 0.09		^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$
1.79 ± 0.63 ± 0.05	58	³ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R15
NODE=M055R15

NEW

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(3.40 \pm 0.03 \pm 0.19 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 06R reports $(2.0 \pm 0.5 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R15;LINKAGE=A
NODE=M055R15;LINKAGE=B

NODE=M055R15;LINKAGE=AB

$\Gamma(a_2(1320)^+\pi^-\text{+c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.176 ± 0.023 ± 0.005	^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.18 \pm 0.01 \pm 0.02 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R72
NODE=M055R72

NODE=M055R72;LINKAGE=A
NODE=M055R72;LINKAGE=B

$\Gamma(a_2(1700)^+\pi^-\text{+c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.6 ± 0.7 ± 0.1	^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.7 \pm 0.4 \pm 0.6 \pm 0.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1700)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R75
NODE=M055R75

NODE=M055R75;LINKAGE=A
NODE=M055R75;LINKAGE=B

$\Gamma(f_2(1270)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.5 ± 0.6 ± 0.1	^{1,2} ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.36 \pm 0.01 \pm 0.06 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R73
NODE=M055R73

OCCUR=2

NODE=M055R73;LINKAGE=A
NODE=M055R73;LINKAGE=D

$$\Gamma(f_4(2050)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{30}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.5±0.9±0.1	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(2.6 \pm 0.4 \pm 0.8 \pm 0.1) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_4(2050)\eta \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R74
NODE=M055R74

NODE=M055R74;LINKAGE=A
NODE=M055R74;LINKAGE=B

$$\Gamma(\pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{31}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5 × 10⁻⁵	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 4.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R76
NODE=M055R76

NODE=M055R76;LINKAGE=A
NODE=M055R76;LINKAGE=B

$$\Gamma(\pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{32}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.5 × 10⁻⁵	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 1.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R77
NODE=M055R77

NODE=M055R77;LINKAGE=A
NODE=M055R77;LINKAGE=B

$$\Gamma(\pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{33}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻⁶	90	1,2 ABLIKIM	17K BES3	$\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R78
NODE=M055R78

NODE=M055R78;LINKAGE=A
NODE=M055R78;LINKAGE=B

$$\Gamma(f_2(1270)\eta)/\Gamma_{\text{total}} \quad \Gamma_{34}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.67±0.11 OUR AVERAGE				

0.63±0.11±0.02 1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma\eta\pi^+\pi^-$

2.7 ±0.8 ±0.1 53 3 ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ ABLIKIM 17K reports $(6.4 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² From an amplitude analysis using an isobar model.

³ ABLIKIM 06R reports $(3.0 \pm 0.7 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R16
NODE=M055R16

NODE=M055R16;LINKAGE=B

NODE=M055R16;LINKAGE=D
NODE=M055R16;LINKAGE=C

$$\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}} \quad \Gamma_{35}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.2±0.4±0.1	1 ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R28
NODE=M055R28

NODE=M055R28;LINKAGE=AT

$\Gamma(K^+ K^- \eta'(958))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	EPTS	DOCUMENT ID	TECN	COMMENT
8.75 ± 0.87	310	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R64
 NODE=M055R64

¹ Derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.2 \pm 0.4)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

NODE=M055R64;LINKAGE=A

 $\Gamma(K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	EPTS	DOCUMENT ID	TECN	COMMENT
$1.61 \pm 0.19 \pm 0.24$	351	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+ (K_S^0 K \pi)$

NODE=M055R93
 NODE=M055R93

¹ AAIJ 23AH reports $(1.61 \pm 0.19 \pm 0.19 \pm 0.14) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R93;LINKAGE=B

 $\Gamma(K_2^*(1430) \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	EPTS	DOCUMENT ID	TECN	COMMENT
$1.17 \pm 0.16 \pm 0.11$	278	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+ (K_S^0 K \pi)$

NODE=M055R94
 NODE=M055R94

¹ AAIJ 23AH reports $(1.17 \pm 0.16 \pm 0.05 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_2^*(1430) \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})]$ assuming $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

NODE=M055R94;LINKAGE=B

 $\Gamma(K_0^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$6.41 \pm 0.57^{+2.09}_{-2.71}$	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R65
 NODE=M055R65

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R65;LINKAGE=A

 $\Gamma(f_0(980) \eta'(958))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.65 \pm 0.47^{+1.32}_{-0.56}$	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R66
 NODE=M055R66

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R66;LINKAGE=A

 $\Gamma(f_0(1710) \eta'(958))/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.71 \pm 0.22^{+0.68}_{-0.48}$	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R67
 NODE=M055R67

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R67;LINKAGE=A

 $\Gamma(f_2'(1525) \eta'(958))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.92 \pm 0.23^{+0.55}_{-0.51}$	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M055R68
 NODE=M055R68

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R68;LINKAGE=A

 $\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
0.35 ± 0.09		ABLIKIM	18D BES3	$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

NODE=M055R18
 NODE=M055R18

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	¹ ABLIKIM	11D BES3	$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

¹ ABLIKIM 11D reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R18;LINKAGE=BR

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
32 ± 21	¹ TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R9
 NODE=M055R9

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R9;LINKAGE=T

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.36±0.04	28.4 ± 5.5	^{1,2} ABLIKIM	04H BES	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M055R26
 NODE=M055R26

¹ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R26;LINKAGE=AB

² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

NODE=M055R26;LINKAGE=AL

 $\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4 × 10⁻⁴	90	3.2 ± 2.4	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

NODE=M055R06
 NODE=M055R06

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R06;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.35±0.10±0.01	22	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4 K_S^0$

NODE=M055R82
 NODE=M055R82

¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (3.4 \pm 0.9 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M055R82;LINKAGE=A

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.15±0.01	17	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2 K^+ 2 K^-$

NODE=M055R07
 NODE=M055R07

¹ ABLIKIM 06T reports $(0.46 \pm 0.16 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R07;LINKAGE=AB

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.27±0.28±0.46	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R69
 NODE=M055R69

 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.62±0.12±0.28	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R70
 NODE=M055R70

 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75±0.06±0.08	373	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R62
 NODE=M055R62

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R62;LINKAGE=A

 $\Gamma(\omega \omega)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.57±0.7±0.2	597	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

NODE=M055R49
 NODE=M055R49

¹ ABLIKIM 11K reports $(6.0 \pm 0.3 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R49;LINKAGE=AL

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.78±0.04±0.08	628	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R61
 NODE=M055R61

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R61;LINKAGE=A

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

0.27±0.04±0.01	105	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.21±0.06±0.01	15	^{2,3} ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ = $(2.67 \pm 0.31 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 11K reports $(0.22 \pm 0.06 \pm 0.02) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by ABLIKIM 19J.

NODE=M055R50
NODE=M055R50

NODE=M055R50;LINKAGE=A

NODE=M055R50;LINKAGE=AL

NODE=M055R50;LINKAGE=B

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

4.26±0.21 OUR AVERAGE [(4.2 ± 0.5) × 10⁻⁴ OUR 2023 AVERAGE]

4.26±0.17±0.12	1529	^{1,2} ABLIKIM	23N BES3	$\psi(2S) \rightarrow \gamma$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2 ± 0.5 ± 0.1	366	³ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ Using $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

² ABLIKIM 23N reports $(4.26 \pm 0.13 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 11K reports $(4.4 \pm 0.3 \pm 0.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R51
NODE=M055R51

NEW

NODE=M055R51;LINKAGE=C

NODE=M055R51;LINKAGE=D

NODE=M055R51;LINKAGE=AL

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

3.0±0.5±0.1	83.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma\phi\phi\eta$

¹ ABLIKIM 20B reports $(2.96 \pm 0.43 \pm 0.22) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R85
NODE=M055R85

NODE=M055R85;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

0.155±0.018 OUR AVERAGE

0.163±0.019±0.004	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$

0.112±0.047±0.003	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.75 \pm 0.16 \pm 0.13 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ = $(9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R21
NODE=M055R21

NODE=M055R21;LINKAGE=ON

NODE=M055R21;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

0.145±0.024±0.004		¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.15	90	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R27
NODE=M055R27

- ¹ ONYISI 10 reports $(1.56 \pm 0.22 \pm 0.14 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ATHAR 07 reports $< 0.16 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R27;LINKAGE=ON

NODE=M055R27;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{61}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.212±0.030±0.006	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$

NODE=M055R43
NODE=M055R43

- ¹ ONYISI 10 reports $(2.28 \pm 0.28 \pm 0.16 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R43;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{62}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7 × 10⁻⁵	90	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M055R48
NODE=M055R48

- ¹ ABLIKIM 11F reports $< 1.82 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R48;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{63}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.50±0.19 OUR EVALUATION	Treating systematic error as correlated.		
0.50±0.19 OUR AVERAGE			

NODE=M055R7
NODE=M055R7

→ UNCHECKED ←

0.46±0.12±0.15

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$

1.08±0.77±0.05

¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$

- ¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

NODE=M055R7;LINKAGE=X2

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ **Γ_{64}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5 × 10⁻⁴	90	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

NODE=M055R38
NODE=M055R38

- ¹ HE 08B reports $< 0.05 \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R38;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ **Γ_{65}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.27±0.22±0.04	82 ± 9	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M055R45
NODE=M055R45

- ¹ ABLIKIM 11F reports $(1.35 \pm 0.15 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R45;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ **Γ_{66}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	¹ ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$

NODE=M055R02
NODE=M055R02

- ¹ Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

NODE=M055R;LINKAGE=AB

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ **Γ_{67}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8±0.5±0.1	1412	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$

NODE=M055R56
NODE=M055R56

- ¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.37 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R56;LINKAGE=AL

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9±0.5±0.1	1625	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

NODE=M055R57
 NODE=M055R57

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (0.38 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R57;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.3±1.1±0.3	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

NODE=M055R58
 NODE=M055R58

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.00 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R58;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.1±1.1±0.3	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M055R59
 NODE=M055R59

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (0.98 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R59;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
29±5±1		105	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R01
 NODE=M055R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

<150	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 12I reports $(31.1 \pm 3.4 \pm 3.9) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R01;LINKAGE=AL

² Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

NODE=M055R01;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
25±6±1	13	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M055R19
 NODE=M055R19

¹ ABLIKIM 12I reports $(26.2 \pm 5.5 \pm 3.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R19;LINKAGE=AL

 $\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 × 10⁻⁴	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M055R52
 NODE=M055R52

¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R52;LINKAGE=AL

 $\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$

NODE=M055R53
 NODE=M055R53

¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R53;LINKAGE=AL

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

4.2 ± 0.4 OUR AVERAGE Error includes scale factor of 1.2. $[(4.2 \pm 0.4) \times 10^{-4}]$ OUR 2023 AVERAGE Scale factor = 1.2]

$9.2^{+2.8}_{-2.4} \pm 0.4$	24	¹ LU	19	BELL	$B^+ \rightarrow \bar{p} \Lambda K^+ K^+$
$4.2 \pm 0.4 \pm 0.1$	3k	^{2,3} ABLIKIM	13D	BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
$3.1 \pm 0.9 \pm 0.1$		⁴ ATHAR	07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ LU 19 reports $(9.15^{+2.63}_{-2.25} \pm 0.86) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(1P) K^+)]$ assuming $B(B^+ \rightarrow \chi_{c1}(1P) K^+) = (4.79 \pm 0.23) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \chi_{c1}(1P) K^+) = (4.74 \pm 0.22) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13D reports $(4.5 \pm 0.2 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

⁴ ATHAR 07 reports $(3.3 \pm 0.9 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R22
NODE=M055R22

NEW

NODE=M055R22;LINKAGE=A

NODE=M055R22;LINKAGE=AB

NODE=M055R22;LINKAGE=LB

NODE=M055R22;LINKAGE=AT

 $\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

1.66 ± 0.16 ± 0.05 399 ¹ ABLIKIM 21AV BES3 $\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$

¹ ABLIKIM 21AV reports $(1.66 \pm 0.12 \pm 0.12) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0975 \pm 0.0024$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.

NODE=M055R89
NODE=M055R89

NODE=M055R89;LINKAGE=A

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

4.9 ± 0.7 ± 0.1 328 ¹ ABLIKIM 19AU BES3 $\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (4.8 \pm 0.5 \pm 0.4) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R86
NODE=M055R86

NODE=M055R86;LINKAGE=F

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT

1.71 ± 0.44 ± 0.05 48 ± 10 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R46
NODE=M055R46

NODE=M055R46;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 9 × 10⁻⁵ 90 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $< 1.00 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R47
NODE=M055R47

NODE=M055R47;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

$4.2 \pm 0.6 \pm 0.1$		103	¹ ABLIKIM	18v BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

<4	90	3.8 ± 2.5	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

¹ ABLIKIM 18v reports $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (0.41 \pm 0.05 \pm 0.03) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13H reports $< 0.62 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

³ NAIK 08 reports $< 0.44 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R32
NODE=M055R32

NODE=M055R32;LINKAGE=B

NODE=M055R32;LINKAGE=AB

NODE=M055R32;LINKAGE=NA

 $\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

$3.6 \pm 0.6 \pm 0.1$		59	¹ ABLIKIM	18v BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

<6	90	4.3 ± 2.3	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

¹ ABLIKIM 18v reports $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (0.35 \pm 0.06 \pm 0.02) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13H reports $< 0.87 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

³ NAIK 08 reports $< 0.65 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R33
NODE=M055R33

NODE=M055R33;LINKAGE=B

NODE=M055R33;LINKAGE=AB

NODE=M055R33;LINKAGE=NA

 $\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

$5.7 \pm 1.5 \pm 0.2$	214	¹ ABLIKIM	20i BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

¹ ABLIKIM 20i reports $(5.7 \pm 1.4 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R87
NODE=M055R87

NODE=M055R87;LINKAGE=A

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$< 9 \times 10^{-5}$	90	¹ ABLIKIM	12i BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12i reports $< 10 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R54
NODE=M055R54

NODE=M055R54;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$< 5 \times 10^{-5}$	90	¹ ABLIKIM	12i BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12i reports $< 5.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R55
NODE=M055R55

NODE=M055R55;LINKAGE=AL

$\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.35±0.24±0.04	49	¹ ABLIKIM	15I BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M055R71
 NODE=M055R71

¹ ABLIKIM 15I reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.32 \pm 0.20 \pm 0.12) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R71;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±1.2±0.2		325	¹ ABLIKIM	220 BES3	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6 90 1.7 ± 2.4 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

¹ ABLIKIM 220 reports $(0.75 \pm 0.11 \pm 0.06) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R34
 NODE=M055R34

NODE=M055R34;LINKAGE=A

² NAIK 08 reports $< 0.60 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R34;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.60±0.06 OUR AVERAGE					

0.58±0.06±0.02 692 ¹ ABLIKIM 220 BES3 $\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$

0.80±0.21±0.02 16.4 ± 4.3 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3.4 90 ³ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 220 reports $(0.58 \pm 0.04 \pm 0.05) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R03
 NODE=M055R03

NODE=M055R03;LINKAGE=A

² NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R03;LINKAGE=NA

³ Using $B(\psi(2S) \rightarrow \chi_{c1} \gamma) (9.1 \pm 0.6)\%$.

NODE=M055R03;LINKAGE=AB

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.49±0.23±0.10	277	ABLIKIM	23T BES3	$\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$

NODE=M055R91
 NODE=M055R91

 $[\Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-)]/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<21 × 10⁻⁴ ¹ FELDMAN 77 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<38 × 10⁻⁴ 90 ¹ BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

NODE=M055R2
 NODE=M055R2

NODE=M055R2;LINKAGE=T

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6 × 10⁻⁵	90	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 0.6 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R04
 NODE=M055R04

NODE=M055R04;LINKAGE=AB

$\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-3}$	90	1,2 ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<4.4 \times 10^{-3}$	90	1,3 ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.				
² Using the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.				
³ Using the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.				

NODE=M055R63
NODE=M055R63

OCCUR=2

NODE=M055R63;LINKAGE=A
NODE=M055R63;LINKAGE=B
NODE=M055R63;LINKAGE=C

NODE=M055310

————— RADIATIVE DECAYS —————

$\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
216 ± 17 OUR AVERAGE				
215 ± 22 ± 6	432 ± 25	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
217 ± 24 ± 6	186 ± 15	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

NODE=M055R29
NODE=M055R29

NODE=M055R29;LINKAGE=AB

¹ ABLIKIM 11E reports $(228 \pm 13 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(243 \pm 19 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R29;LINKAGE=BE

$\Gamma(\gamma \omega)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
68 ± 8 OUR AVERAGE				
66 ± 9 ± 2	136 ± 14	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \omega$
74 ± 17 ± 2	39 ± 7	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \omega$

NODE=M055R30
NODE=M055R30

NODE=M055R30;LINKAGE=AB

¹ ABLIKIM 11E reports $(69.7 \pm 7.2 \pm 6.6) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(83 \pm 15 \pm 12) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R30;LINKAGE=BE

$\Gamma(\gamma \phi)/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
24 ± 5 ± 1		43 ± 9	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<23	90	5.2 ± 3.1	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \phi$

NODE=M055R31
NODE=M055R31

NODE=M055R31;LINKAGE=AB

¹ ABLIKIM 11E reports $(25.8 \pm 5.2 \pm 2.3) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $<26 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R31;LINKAGE=BE

$\Gamma(\gamma \gamma)/\Gamma_{\text{total}}$ Γ_{100}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.3 \times 10^{-6}$	90	ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<3.5 \times 10^{-5}$	90	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow 3\gamma$
$<150 \times 10^{-5}$	90	¹ YAMADA	77 DASP	$e^+e^- \rightarrow 3\gamma$

NODE=M055R3
NODE=M055R3

NODE=M055R;LINKAGE=T1

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

$\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.65 \pm 0.23 \pm 0.10$	1.9k	^{1,2} ABLIKIM	17I	BES3 $\psi(2S) \rightarrow \gamma e^+ e^- J/\psi$

¹ ABLIKIM 17I reports $(3.73 \pm 0.09 \pm 0.25) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow e^+ e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent from other measurements reported by ABLIKIM 17I

NODE=M055R79
NODE=M055R79

NODE=M055R79;LINKAGE=B

NODE=M055R79;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ Γ_{101}/Γ_{96}

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

$10.1 \pm 0.3 \pm 0.5$	1.9k	¹ ABLIKIM	17I	BES3 $\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

¹ Uses $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (351.8 \pm 1.0 \pm 12.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M055R80
NODE=M055R80

NODE=M055R80;LINKAGE=A

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$ $\Gamma_{102}/\Gamma_{101}$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

$6.73 \pm 0.51 \pm 0.50$	222	ABLIKIM	19Z	BES3 $\psi(2S) \rightarrow \gamma \chi_c \rightarrow \gamma(\mu^+\mu^- J/\psi)$

NODE=M055R84
NODE=M055R84

 $\chi_{c1}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M055230

$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{58}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

2.13 ± 0.13 OUR FIT	Error includes scale factor of 1.3. $[(2.14 \pm 0.10) \times 10^{-5}$ OUR 2023 FIT]		

1.1 ± 1.0	¹ BAI	98I	BES $\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow \gamma p\bar{p}$

¹ Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B1
NODE=M055B1

NEW

NODE=M055B;LINKAGE=J2

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}$
 $\Gamma_{71}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

12.4 ± 0.9 OUR FIT	Error includes scale factor of 1.1. $[(12.4 \pm 0.8) \times 10^{-6}$ OUR 2023 FIT]		

12.3 ± 0.9 OUR AVERAGE Error includes scale factor of 1.2.

$12.8 \pm 0.6 \pm 0.6$	528	ABLIKIM	21L	BES3 $\psi(2S) \rightarrow \gamma p\pi^- \bar{p}\pi^+$
$10.5 \pm 1.6 \pm 0.6$	46	¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$11.2 \pm 1.0 \pm 0.9$	136	^{2,3} ABLIKIM	13H	BES3 $\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (11.6 \pm 1.8 \pm 0.7 \pm 0.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

² Superseded by ABLIKIM 21L

³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (12.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ from a measurement of $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma \chi_{c1})$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.2 \pm 0.4)\%$.

NODE=M055B10
NODE=M055B10

NEW

NODE=M055B10;LINKAGE=NA

NODE=M055B10;LINKAGE=A
NODE=M055B10;LINKAGE=AB

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$
 $\Gamma_{71}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

3.58 ± 0.25 OUR FIT	Error includes scale factor of 1.1. $[(3.58 \pm 0.22) \times 10^{-5}$ OUR 2023 FIT]		

$7.1 \pm 2.8 \pm 1.3$	$9.0 \pm 3.5 \pm 3.1$	¹ BAI	03E	BES $\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c1}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (1.33 \pm 0.52 \pm 0.46 \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M055B11
NODE=M055B11

NEW

NODE=M055B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \Lambda \bar{\Lambda} \eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{76}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
5.72 ± 1.34 ± 0.65	21	ABLIKIM	22AO BES3	$\psi(2S) \rightarrow \gamma p \pi^- \bar{p} \pi^+ \gamma \gamma$

NODE=M055R90
NODE=M055R90

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{96}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.34 ± 0.10 OUR FIT		Error includes scale factor of 1.7. $[(3.34 \pm 0.06) \times 10^{-2} \text{ OUR } 2023 \text{ FIT}]$		

NODE=M055B2
NODE=M055B2

NEW

3.24 ± 0.16 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

3.518 ± 0.010 ± 0.120	143k	¹ ABLIKIM	17N	BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$
3.442 ± 0.010 ± 0.132	1.9M	ABLIKIM	17U	BES3	$e^+ e^- \rightarrow \gamma X$
2.81 ± 0.05 ± 0.23	13k	BAI	04I	BES2	$\psi(2S) \rightarrow J/\psi \gamma \gamma$
2.56 ± 0.12 ± 0.20		GAISER	86	CBAL	$\psi(2S) \rightarrow \gamma X$
2.78 ± 0.30		² OREGLIA	82	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.2 ± 0.5		³ BRANDELIK	79B	DASP	$\psi(2S) \rightarrow \gamma \chi_{c1}$
2.9 ± 0.5		³ BARTEL	78B	CNTR	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.0 ± 1.5		⁴ BIDDICK	77	CNTR	$e^+ e^- \rightarrow \gamma X$
2.8 ± 0.9		² WHITAKER	76	MRK1	$e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.377 ± 0.009 ± 0.183	142k	⁵ ABLIKIM	12O	BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3.56 ± 0.03 ± 0.12	24.9k	⁶ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3.44 ± 0.06 ± 0.13	3.7k	⁷ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

⁴ Assumes isotropic gamma distribution.

⁵ Superseded by ABLIKIM 17N.

⁶ Not independent from other measurements of MENDEZ 08.

⁷ Not independent from other values reported by ADAM 05A.

NODE=M055B2;LINKAGE=A

NODE=M055B;LINKAGE=3Q

NODE=M055B;LINKAGE=2Q

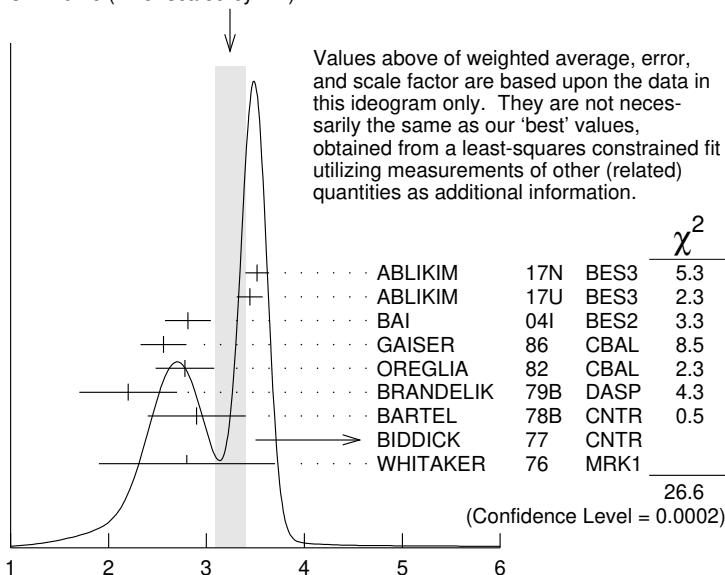
NODE=M055B;LINKAGE=EA

NODE=M055B2;LINKAGE=B

NODE=M055B2;LINKAGE=ME

NODE=M055B;LINKAGE=AD

WEIGHTED AVERAGE
3.24 ± 0.16 (Error scaled by 2.1)



$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{10^{-2}}$$

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{96}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
9.63±0.29 OUR FIT Error includes scale factor of 1.7. $[(9.63 \pm 0.17) \times 10^{-2}$ OUR 2023 FIT]

10.15±0.28 OUR AVERAGE

10.17±0.07±0.27 24.9k MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c1}$
 12.6 ±0.3 ±3.8 3k ¹ ABLIKIM 04B BES $\psi(2S) \rightarrow J/\psi X$
 8.5 ±2.1 ² HIMEL 80 MRK2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.24±0.17±0.23 3.7k ³ ADAM 05A CLEO Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c1}) \times B(\chi_{c1} \rightarrow \gamma J/\psi(1S))$ quoted in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Not independent from other values reported by ADAM 05A.

NODE=M055B3
 NODE=M055B3

NEW

NODE=M055B;LINKAGE=AB
 NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{19}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
6.8±0.6 OUR FIT Error includes scale factor of 1.1. $[(6.8 \pm 0.5) \times 10^{-4}$ OUR 2023 FIT]

7.2±0.6 OUR AVERAGE

7.3±0.5±0.5 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$
 7.0±0.5±0.9 ² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-) = (4.0 \pm 0.3 \pm 0.5) \times 10^{-3}$. We use $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.4) \times 10^{-2}$.

NODE=M055B16
 NODE=M055B16

NEW

NODE=M055B16;LINKAGE=AT

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{19}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
19.6±1.6 OUR FIT Error includes scale factor of 1.1. $[(19.6 \pm 1.6) \times 10^{-4}$ OUR 2023 FIT]

13.2±2.4±3.2 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B17
 NODE=M055B17

NEW

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{48}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
0.53±0.11 OUR FIT

0.61±0.11±0.08 54 ¹ ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$.

NODE=M055B14
 NODE=M055B14

NODE=M055B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{48}/\Gamma \times \Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}{\Gamma_{180}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
1.52±0.31 OUR FIT

1.13±0.40±0.29 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M055B15
 NODE=M055B15

NODE=M055B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{58}}{\Gamma} \times \frac{\Gamma_{180}^{\psi(2S)}}{\Gamma\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.4±0.4 OUR FIT	Error includes scale factor of 1.3. [(7.41 ± 0.35) × 10 ⁻⁶ OUR 2023 FIT]			

NODE=M055B6
NODE=M055B6

NEW

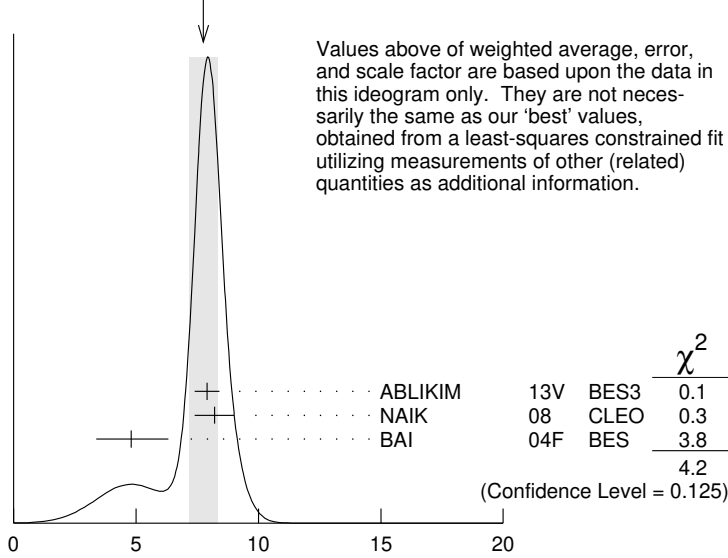
7.8±0.6 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

7.9±0.4±0.3	453	ABLIKIM	13v	BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$
8.2±0.7±0.4	141 ± 13	¹ NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
4.8 ^{+1.4} _{-1.3} ±0.6	18.2 ^{+5.5} _{-4.9}	BAI	04F	BES	$\psi(2S) \rightarrow \gamma\chi_{c1}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p\bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B6;LINKAGE=NA

WEIGHTED AVERAGE
7.8±0.6 (Error scaled by 1.4)



$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))}{\Gamma_{\text{total}}} \text{ (units } 10^{-6}\text{)}$$

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{83}}{\Gamma} \times \frac{\Gamma_{180}^{\psi(2S)}}{\Gamma\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.49±0.09±0.07	258	¹ ABLIKIM	19BB	BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

NODE=M055B01
NODE=M055B01

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c1} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (1.53 \pm 0.10 \pm 0.08) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 18.

NODE=M055B01;LINKAGE=A

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{84}}{\Gamma} \times \frac{\Gamma_{180}^{\psi(2S)}}{\Gamma\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.07±0.06	493	¹ ABLIKIM	20AE	BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

NODE=M055R88
NODE=M055R88

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_{c1} \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (1.46 \pm 0.07 \pm 0.07) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 20.

NODE=M055R88;LINKAGE=A

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

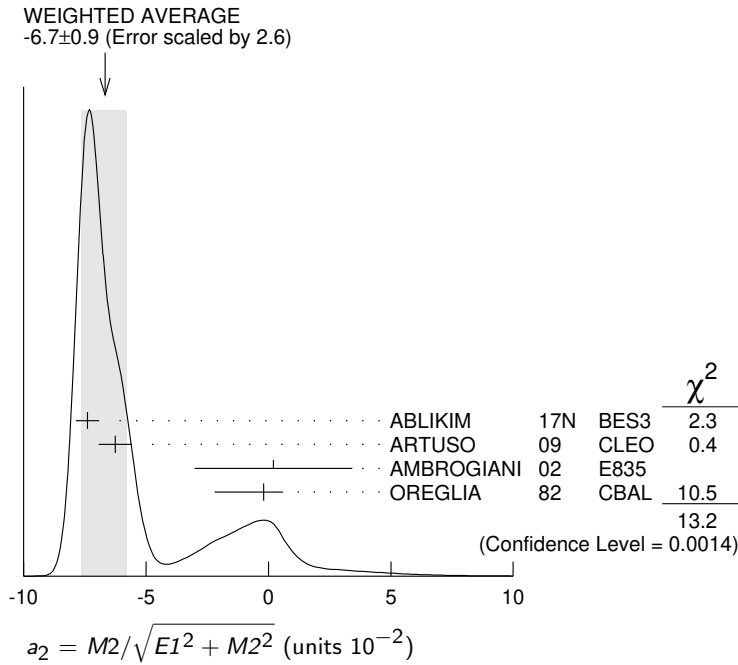
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-6.7 ± 0.9 OUR AVERAGE	Error includes scale factor of 2.6. See the ideogram below.			

-7.40±0.33±0.34	164k	¹ ABLIKIM	17N	BES3 $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-6.26±0.63±0.24	39k	ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
0.2 ± 3.2 ± 0.4	2090	AMBROGIANI	02	E835 $p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi\gamma$
-0.2 ^{+0.8} _{-2.0}	921	OREGLIA	82	CBAL $\psi(2S) \rightarrow \chi_{c1}\gamma \rightarrow J/\psi\gamma\gamma$

NODE=M055A1
NODE=M055A1

¹ Correlated with b_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.

NODE=M055A1;LINKAGE=A



MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma \chi_{c1}(1S)$ RADIATIVE DECAY

NODE=M055250

$b_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055QB2
NODE=M055QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.4 OUR AVERAGE				
2.29 ± 0.39 ± 0.27	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.76 ± 0.73 ± 0.23	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
7.7 ^{+5.0} _{-4.5}	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Correlated with a_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.

NODE=M055QB2;LINKAGE=A

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS $\psi(2S) \rightarrow \gamma \chi_{c1}(1S)$ and $\chi_{c1} \rightarrow \gamma J/\psi(1S)$

NODE=M055260

a_2/b_2 Magnetic quadrupole transition amplitude ratio

NODE=M055QAR
NODE=M055QAR

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
-2.27 ^{+0.57}_{-0.99}	39k	¹ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Not independent of $a_2(\chi_{c1})$ and $b_2(\chi_{c1})$ values from ARTUSO 09.

NODE=M055QAR;LINKAGE=AR

$\chi_{c1}(1P)$ REFERENCES

NODE=M055

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	23N	JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM	23T	PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
ABLIKIM	22AF	PRL 129 122001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61878
ABLIKIM	22AO	PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM	22O	JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM	21AV	JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026
ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)	REFID=59614
ABLIKIM	18D	PRL 121 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58849
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
AAIJ	17BI	PRL 119 221801	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58278
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310

ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57953
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16715
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48552
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	86B	PL B172 455	C. Baglin	(LAPP, CERN, GENO, LYON, OSLO+)	REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
TANENBAUM	75	PRL 35 1323	W.M. Tanenbaum <i>et al.</i>	(LBL, SLAC)	REFID=22106

$h_c(1P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Quantum numbers are quark model prediction, $C = -$ established by $\eta_c \gamma$ decay.

NODE=M144

NODE=M144

NODE=M144M

NODE=M144M

$h_c(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3525.37$\pm$0.14 OUR AVERAGE		Error includes scale factor of 1.2.		
3525.32 $\pm$ 0.06 $\pm$ 0.15	23k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons; $\pi^0 \gamma(\eta_c)$
3525.20 $\pm$ 0.18 $\pm$ 0.12	1282	¹ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3525.8 $\pm$ 0.2 $\pm$ 0.2	13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3525.31 $\pm$ 0.11 $\pm$ 0.14	832	^{2,3} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
3525.40 $\pm$ 0.13 $\pm$ 0.18	3679	² ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
3525.6 $\pm$ 0.5	92	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2(\pi^+ \pi^- \pi^0)$
3524.4 $\pm$ 0.6 $\pm$ 0.4	168	⁴ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3527 $\pm$ 8	42	ANTONIAZZI	94 E705	$300 \pi^\pm, p\text{Li} \rightarrow$ $J/\psi \pi^0 X$
3526.28 $\pm$ 0.18 $\pm$ 0.19	59	⁵ ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$
3525.4 $\pm$ 0.8 $\pm$ 0.4	5	BAGLIN	86 SPEC	$\bar{p}p \rightarrow J/\psi X$

¹ Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \rightarrow \pi^0 h_c \rightarrow \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

² Superseded by ABLIKIM 22AQ

³ With floating width.

⁴ Superseded by DOBBS 08A.

⁵ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

NODE=M144M;LINKAGE=DO

NODE=M144M;LINKAGE=A

NODE=M144M;LINKAGE=AB

NODE=M144M;LINKAGE=RO

NODE=M144M;LINKAGE=NW

$h_c(1P)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.78$^{+0.27}_{-0.24}$$\pm$0.12		23k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons; $\pi^0 \gamma(\eta_c)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.70 $\pm$ 0.28 $\pm$ 0.22		832	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
< 1.44	90	3679	³ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
< 1		13	ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$
< 1.1	90	59	ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$

¹ Superseded by ABLIKIM 22AQ

² With floating mass.

³ The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W

NODE=M144W

NODE=M144W;LINKAGE=A

NODE=M144W;LINKAGE=AL

NODE=M144W;LINKAGE=AB

$h_c(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S)\pi^0$	< 5 $\times 10^{-4}$	90%
Γ_2 $J/\psi(1S)\pi\pi$	not seen	
Γ_3 $J/\psi(1S)\pi^+\pi^-$	< 2.7 $\times 10^{-3}$	90%
Γ_4 $p\bar{p}$	< 1.7 $\times 10^{-4}$	90%
Γ_5 $p\bar{p}\pi^0$	< 8 $\times 10^{-4}$	90%
Γ_6 $p\bar{p}\pi^+\pi^-$	(3.3 $\pm$ 0.6) $\times 10^{-3}$	
Γ_7 $p\bar{p}\pi^0\pi^0$	< 6 $\times 10^{-4}$	90%
Γ_8 $p\bar{p}\pi^+\pi^-\pi^0$	(4.4 $\pm$ 1.3) $\times 10^{-3}$	
Γ_9 $p\bar{p}\eta$	(7.4 $\pm$ 2.2) $\times 10^{-4}$	
Γ_{10} $\pi^+\pi^-\pi^0$	(1.9 $\pm$ 0.5) $\times 10^{-3}$	
Γ_{11} $\pi^+\pi^-\pi^0\eta$	(8.3 $\pm$ 2.4) $\times 10^{-3}$	

NODE=M144215;NODE=M144

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=10

DESIG=3

DESIG=24

DESIG=11

DESIG=13

DESIG=25

DESIG=23

DESIG=5

DESIG=14

Γ_{12}	$2\pi^+ 2\pi^- \pi^0$	$(9.4 \pm 1.7) \times 10^{-3}$		DESIG=6
Γ_{13}	$3\pi^+ 3\pi^- \pi^0$	< 1.0	%	90% DESIG=7
Γ_{14}	$K^+ K^- \pi^+ \pi^-$	< 7	$\times 10^{-4}$	90% DESIG=12
Γ_{15}	$K^+ K^- \pi^+ \pi^- \pi^0$	$(3.8 \pm 0.8) \times 10^{-3}$		DESIG=15
Γ_{16}	$K^+ K^- \pi^+ \pi^- \eta$	< 2.7	$\times 10^{-3}$	90% DESIG=16
Γ_{17}	$K^+ K^- \pi^0$	< 6	$\times 10^{-4}$	90% DESIG=17
Γ_{18}	$K^+ K^- \pi^0 \eta$	< 2.4	$\times 10^{-3}$	90% DESIG=18
Γ_{19}	$K^+ K^- \eta$	< 1.0	$\times 10^{-3}$	90% DESIG=19
Γ_{20}	$2K^+ 2K^- \pi^0$	< 2.8	$\times 10^{-4}$	90% DESIG=20
Γ_{21}	$K_S^0 K^\pm \pi^\mp$	< 6	$\times 10^{-4}$	90% DESIG=21
Γ_{22}	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(3.2 \pm 1.0) \times 10^{-3}$		DESIG=22

Radiative decays

Γ_{23}	$\gamma \eta$	$(4.7 \pm 2.1) \times 10^{-4}$		NODE=M144;CLUMP=R
Γ_{24}	$\gamma \eta'(958)$	$(1.5 \pm 0.4) \times 10^{-3}$		DESIG=9
Γ_{25}	$\gamma \eta_c(1S)$	$(60 \pm 4) \%$		DESIG=8
				DESIG=4

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and $B^\pm$ with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

$h_c(1P)$ PARTIAL WIDTHS

NODE=M144220

$h_c(1P) \Gamma(i) \Gamma(\bar{p}p) / \Gamma(\text{total})$

NODE=M144223

$\Gamma(\gamma \eta_c(1S)) \times \Gamma(p\bar{p}) / \Gamma_{\text{total}}$					$\Gamma_{25} \Gamma_4 / \Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
12.0 ± 4.5	13	¹ ANDREOTTI	05B E835	$\bar{p}p \rightarrow \eta_c \gamma$	
¹ Assuming $\Gamma = 1$ MeV.					

NODE=M144G1
NODE=M144G1

NODE=M144G1;LINKAGE=AN

$h_c(1P)$ BRANCHING RATIOS

NODE=M144225

$\Gamma(J/\psi(1S)\pi^0) / \Gamma(\gamma \eta_c(1S))$					Γ_1 / Γ_{25}
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 9 \times 10^{-4}$	90	¹ ABLIKIM	22N BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$	
¹ ABLIKIM 22N reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^0) / \Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))] / [B(\eta_c \rightarrow K^+ K^- \pi^0)] < 7.5 \times 10^{-2}$ which we multiply by our best value $B(\eta_c \rightarrow K^+ K^- \pi^0) = 1/6 B(\eta_c(1S) \rightarrow K \bar{K} \pi) = 1/6 (7.1 \times 10^{-2})$.					

NODE=M144R24
NODE=M144R24

NODE=M144R24;LINKAGE=B

$\Gamma(J/\psi(1S)\pi\pi) / \Gamma(J/\psi(1S)\pi^0)$					Γ_2 / Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 0.18	90	ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$	

NODE=M144R1
NODE=M144R1

$\Gamma(J/\psi(1S)\pi^+ \pi^-) / \Gamma_{\text{total}}$					Γ_3 / Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 2.7 \times 10^{-3}$	90	¹ ABLIKIM	18M BES3	$\psi(2S) \rightarrow \pi^0 \pi^+ \pi^- J/\psi$	
¹ ABLIKIM 18M reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.0 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.					

NODE=M144R07
NODE=M144R07

OCCUR=2

NODE=M144R07;LINKAGE=B

$\Gamma(p\bar{p}) / \Gamma_{\text{total}}$					Γ_4 / Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$< 1.7 \times 10^{-4}$	90	¹ ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p \bar{p}$	
¹ ABLIKIM 13V reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 1.3 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.					

NODE=M144R20
NODE=M144R20

NODE=M144R20;LINKAGE=A

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8 \times 10^{-4}$	90	¹ ABLIKIM	22M BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R22
 NODE=M144R22

¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 5.67 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R22;LINKAGE=A

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.3 \pm 0.5 \pm 0.2$	230	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R08
 NODE=M144R08

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.49 \pm 0.27 \pm 0.28) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R08;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-4}$	90	12	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R10
 NODE=M144R10

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.4 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R10;LINKAGE=A

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.4 \pm 1.2 \pm 0.3$	86	¹ ABLIKIM	22M BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R23
 NODE=M144R23

¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (3.30 \pm 0.71 \pm 0.59) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R23;LINKAGE=A

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.4 \pm 2.1 \pm 0.5$	20	¹ ABLIKIM	22M BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R21
 NODE=M144R21

¹ ABLIKIM 22M reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (5.51 \pm 1.50 \pm 0.46) \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R21;LINKAGE=A

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

<i>VALUE</i> (units 10^{-3})	<i>CL%</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
1.9±0.5±0.1	101	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$	

NODE=M144R01
 NODE=M144R01

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.6	90	² ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

NODE=M144R01;LINKAGE=A

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (1.38 \pm 0.35 \pm 0.17) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 0.19 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R01;LINKAGE=AD

 $\Gamma(\pi^+\pi^-\pi^0\eta)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.3 \pm 2.3 \pm 0.6$	35	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R11
 NODE=M144R11

¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (6.2 \pm 1.6 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R11;LINKAGE=A

 $\Gamma(2\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.94 ± 0.17 OUR AVERAGE				

NODE=M144R02
 NODE=M144R02

$0.86 \pm 0.16 \pm 0.06$	254	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

$2.5^{+0.9}_{-0.7} \pm 0.2$	92	² ADAMS	09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

- ¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+ 2\pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (6.40 \pm 0.81 \pm 0.87) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+ 2\pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (1.88^{+0.48+0.47}_{-0.45-0.30}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=A

NODE=M144R02;LINKAGE=AD

$\Gamma(3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{13}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.010	90	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$	

NODE=M144R03
NODE=M144R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

- <0.034 90 ² ADAMS 09 CLEO $\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
- ¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow 3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 7.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.
- ² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 3\pi^+ 3\pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R03;LINKAGE=A

NODE=M144R03;LINKAGE=AD

$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<7 × 10⁻⁴	90	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$	

NODE=M144R09
NODE=M144R09

- ¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 0.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R09;LINKAGE=A

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{15}/Γ
VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT	
3.8 ± 0.8 ± 0.3	80	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$	

NODE=M144R12
NODE=M144R12

- ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.8 \pm 0.5 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R12;LINKAGE=A

$\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$					Γ_{16}/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<2.7 × 10⁻³	90	24	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R13
NODE=M144R13

- ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.0 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R13;LINKAGE=A

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$					Γ_{17}/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<6 × 10⁻⁴	90	20	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R14
NODE=M144R14

- ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.8 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R14;LINKAGE=A

$\Gamma(K^+ K^- \pi^0 \eta)/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻³	90	20	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R15
NODE=M144R15

- ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \pi^0 \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 1.8 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R15;LINKAGE=A

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.0 × 10⁻³	90	18	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

NODE=M144R16
NODE=M144R16

- ¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 7.5 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.

NODE=M144R16;LINKAGE=A

$\Gamma(2K^+ 2K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-4}$	90	11	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow 2K^+ 2K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 2.1 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.					

NODE=M144R17
 NODE=M144R17

NODE=M144R17;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-4}$	90	17	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] < 4.8 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = 7.4 \times 10^{-4}$.					

NODE=M144R18
 NODE=M144R18

NODE=M144R18;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.2 \pm 1.0 \pm 0.2$	41	¹ ABLIKIM	20AH BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
¹ ABLIKIM 20AH reports $[\Gamma(h_c(1P) \rightarrow K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (2.4 \pm 0.7 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M144R19
 NODE=M144R19

NODE=M144R19;LINKAGE=A

RADIATIVE DECAYS

 $\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.7 \pm 1.5 \pm 1.4$	18	ABLIKIM	16I BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta$

NODE=M144230

NODE=M144R06
 NODE=M144R06

 $\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.52 \pm 0.27 \pm 0.29$	44	ABLIKIM	16I BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta'(958)$

NODE=M144R00
 NODE=M144R00

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
60 ± 4 OUR FIT				
57 ± 5 OUR AVERAGE				
57 ± 4 ± 4	23k	¹ ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0 \text{ hadrons};$ $\pi^0 \gamma(\eta_c)$
56 ± 6 ± 4		² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
62 ± 9 ± 4	3679	^{3,4} ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
56 ± 7 ± 4	1282	⁵ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
54 ± 14 ± 4	168	⁶ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

NODE=M144R2
 NODE=M144R2

OCCUR=2

¹ ABLIKIM 22AQ reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.22^{+0.27}_{-0.26} \pm 0.19) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=C

² Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DB

³ ABLIKIM 10B reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.58 \pm 0.40 \pm 0.50) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=A

⁴ Superseded by ABLIKIM 22AQ

NODE=M144R2;LINKAGE=B

⁵ DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=DO

⁶ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow h_c(1P)\pi^0)] = (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow h_c(1P)\pi^0) = (7.4 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R2;LINKAGE=RO

$h_c(1P)$ REFERENCES

ABLIKIM	22AQ	PR D106 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22M	JHEP 2205 108	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		JHEP 2303 022 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22N	JHEP 2205 003	M. Ablikim	(BESIII Collab.)
ABLIKIM	20AH	PR D102 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AG	PR D99 072008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18M	PR D97 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	16I	PRL 116 251802	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12N	PR D86 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADAMS	09	PR D80 051106	G.S. Adams <i>et al.</i>	(CLEO Collab.)
DOBBS	08A	PRL 101 182003	S. Dobbs <i>et al.</i>	(CLEO Collab.)
ANDREOTTI	05B	PR D72 032001	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)
ARMSTRONG	92D	PRL 69 2337	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
BAGLIN	86	PL B171 135	C. Baglin <i>et al.</i>	(LAPP, CERN, TORI, STRB+)

NODE=M144

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REFID=43180

 $\chi_{c2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

See the Review on “Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ ” before the $\chi_{c0}(1P)$ Listings.

NODE=M057

NODE=M057

 $\chi_{c2}(1P)$ MASS

NODE=M057M

NODE=M057M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3556.17 ± 0.07 OUR AVERAGE				
3557.3 ± 1.7 ± 0.7	611	¹ AAIJ	17BB LHCB	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+ K^-)X$
3556.10 ± 0.06 ± 0.11	4.0k	² AAIJ	17BI LHCB	$\chi_{c2} \rightarrow J/\psi \mu^+ \mu^-$
3555.3 ± 0.6 ± 2.2	2.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \text{hadrons}$
3555.70 ± 0.59 ± 0.39		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$
3556.173 ± 0.123 ± 0.020		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
3559.9 ± 2.9		EISENSTEIN	01 CLE2	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
3556.4 ± 0.7		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3556.22 ± 0.131 ± 0.020	585	³ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
3556.9 ± 0.4 ± 0.5	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+ e^- X$
3557.8 ± 0.2 ± 4		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3553.4 ± 2.2	66	⁵ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3555.9 ± 0.7		⁶ OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3557 ± 1.5	69	⁷ HIMEL	80 MRK2	$e^+ e^- \rightarrow J/\psi 2\gamma$
3551 ± 11	15	BRANDELIK	79B DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
3553 ± 4		⁷ BARTEL	78B CNTR	$e^+ e^- \rightarrow J/\psi 2\gamma$
3553 ± 4 ± 4		^{7,8} TANENBAUM	78 MRK1	$e^+ e^-$
3563 ± 7	360	⁷ BIDDICK	77 CNTR	$e^+ e^- \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3555.4 ± 1.3	53	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3543 ± 10	4	WHITAKER	76 MRK1	$e^+ e^- \rightarrow J/\psi 2\gamma$

¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c2}(1P)$ fixed to the PDG 16 value.

² AAIJ 17BI reports also $m(\chi_{c2}) - m(\chi_{c1}) = 45.39 \pm 0.07 \pm 0.03$ MeV.

³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.

⁴ Using mass of $\psi(2S) = 3686.0$ MeV.

⁵ $J/\psi(1S)$ mass constrained to 3097 MeV.

⁶ Assuming $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁷ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

⁸ From a simultaneous fit to radiative and hadronic decay channels.

NODE=M057M;LINKAGE=A

NODE=M057M;LINKAGE=B
NODE=M057M;LINKAGE=NW
NODE=M057M;LINKAGE=C
NODE=M057M;LINKAGE=P
NODE=M057M;LINKAGE=E
NODE=M057M;LINKAGE=D

NODE=M057M;LINKAGE=M

 $\chi_{c2}(1P)$ WIDTH

NODE=M057W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.98 ±0.09 OUR FIT	Error includes scale factor of 1.1.	[1.97 ± 0.09 MeV OUR 2023 FIT]		
2.00 ±0.11 OUR AVERAGE				
2.10 ±0.20 ±0.02	4.0k	AAIJ	17BI LHCb	$\chi_{c2} \rightarrow J/\psi \mu^+ \mu^-$
1.915 ±0.188 ±0.013		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
1.96 ±0.17 ±0.07	585	¹ ARMSTRONG	92 E760	$p\bar{p} \rightarrow e^+ e^- \gamma$
2.6 $\begin{smallmatrix} +1.4 \\ -1.0 \end{smallmatrix}$	50	BAGLIN	86B SPEC	$p\bar{p} \rightarrow e^+ e^- X$
2.8 $\begin{smallmatrix} +2.1 \\ -2.0 \end{smallmatrix}$		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

¹ Recalculated by ANDREOTTI 05A.² Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W

NEW

NODE=M057W;LINKAGE=AN

NODE=M057W;LINKAGE=E

 $\chi_{c2}(1P)$ DECAY MODES

NODE=M057215;NODE=M057

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Hadronic decays		
Γ_1 $2(\pi^+ \pi^-)$	(1.00 ±0.13) %	S=1.4
Γ_2 $\rho\rho$		
Γ_3 $\pi^+ \pi^- \pi^0 \pi^0$	(1.86 ±0.24) %	
Γ_4 $\rho^+ \pi^- \pi^0 + \text{c.c.}$	(2.22 ±0.35) %	
Γ_5 $4\pi^0$	(1.13 ±0.15) $\times 10^{-3}$	
Γ_6 $K^+ K^- \pi^0 \pi^0$	(2.1 ±0.4) $\times 10^{-3}$	
Γ_7 $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	(1.41 ±0.20) %	
Γ_8 $\rho^- K^+ \bar{K}^0 + \text{c.c.}$	(4.2 ±1.3) $\times 10^{-3}$	
Γ_9 $K^*(892)^0 K^- \pi^+ \rightarrow$ $K^- \pi^+ K^0 \pi^0 + \text{c.c.}$	(3.0 ±0.8) $\times 10^{-3}$	
Γ_{10} $K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	(3.9 ±0.9) $\times 10^{-3}$	
Γ_{11} $K^*(892)^- K^+ \pi^0 \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	(3.8 ±0.8) $\times 10^{-3}$	
Γ_{12} $K^*(892)^+ \bar{K}^0 \pi^- \rightarrow$ $K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	(3.0 ±0.8) $\times 10^{-3}$	
Γ_{13} $K^+ K^- \eta \pi^0$	(1.3 ±0.4) $\times 10^{-3}$	
Γ_{14} $K^+ K^- \pi^+ \pi^-$	(8.3 ±1.1) $\times 10^{-3}$	S=1.2
Γ_{15} $K^+ K^- \pi^+ \pi^- \pi^0$	(1.17 ±0.13) %	
Γ_{16} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(7.3 ±0.8) $\times 10^{-3}$	
Γ_{17} $K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	(2.1 ±1.0) $\times 10^{-3}$	
Γ_{18} $K^*(892)^0 \bar{K}^*(892)^0$	(2.2 ±0.9) $\times 10^{-3}$	S=2.3
Γ_{19} $3(\pi^+ \pi^-)$	(1.53 ±0.19) %	S=3.8
Γ_{20} $\phi\phi$	(1.23 ±0.07) $\times 10^{-3}$	S=1.9
Γ_{21} $\phi\phi\eta$	(5.4 ±0.7) $\times 10^{-4}$	
Γ_{22} $\omega\omega$	(8.6 ±1.0) $\times 10^{-4}$	
Γ_{23} $\omega K^+ K^-$	(7.3 ±0.9) $\times 10^{-4}$	
Γ_{24} $\omega\phi$	(9.7 ±2.8) $\times 10^{-6}$	
Γ_{25} $\pi\pi$	(2.27 ±0.10) $\times 10^{-3}$	
Γ_{26} $\rho^0 \pi^+ \pi^-$	(3.6 ±1.5) $\times 10^{-3}$	
Γ_{27} $\pi^+ \pi^- \pi^0 (\text{non-resonant})$	(2.0 ±0.4) $\times 10^{-5}$	
Γ_{28} $\rho(770)^\pm \pi^\mp$	(6 ±4) $\times 10^{-6}$	
Γ_{29} $\pi^+ \pi^- \eta$	(4.9 ±1.3) $\times 10^{-4}$	
Γ_{30} $\pi^+ \pi^- \eta'$	(5.1 ±1.9) $\times 10^{-4}$	
Γ_{31} $\eta\eta$	(5.5 ±0.5) $\times 10^{-4}$	
Γ_{32} $K^+ K^-$	(1.02 ±0.15) $\times 10^{-3}$	S=2.3
Γ_{33} $K_S^0 K_S^0$	(5.3 ±0.4) $\times 10^{-4}$	
Γ_{34} $K^*(892)^\pm K^\mp$	(1.46 ±0.21) $\times 10^{-4}$	
Γ_{35} $K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(1.27 ±0.27) $\times 10^{-4}$	
Γ_{36} $K_2^*(1430)^\pm K^\mp$	(1.51 ±0.13) $\times 10^{-3}$	
Γ_{37} $K_2^*(1430)^0 \bar{K}^0 + \text{c.c.}$	(1.27 ±0.17) $\times 10^{-3}$	
Γ_{38} $K_3^*(1780)^\pm K^\mp$	(5.3 ±0.8) $\times 10^{-4}$	
Γ_{39} $K_3^*(1780)^0 \bar{K}^0 + \text{c.c.}$	(5.7 ±2.1) $\times 10^{-4}$	
Γ_{40} $a_2(1320)^0 \pi^0$	(1.31 ±0.35) $\times 10^{-3}$	

NODE=M057;CLUMP=A

DESIG=3

DESIG=43

DESIG=50

DESIG=51

DESIG=62

DESIG=52

DESIG=54

DESIG=55

DESIG=60

DESIG=56

DESIG=57

DESIG=58

DESIG=59

DESIG=5

DESIG=67

DESIG=78

DESIG=10

DESIG=21

DESIG=4

DESIG=16

DESIG=99

DESIG=25

DESIG=79

DESIG=68

DESIG=22

DESIG=9

DESIG=95

DESIG=96

DESIG=39

DESIG=42

DESIG=14

DESIG=2

DESIG=15

DESIG=87

DESIG=88

DESIG=89

DESIG=90

DESIG=91

DESIG=92

DESIG=93

Г41	$a_2(1320)^\pm \pi^\mp$	$(1.8 \pm 0.6) \times 10^{-3}$		DESIG=94
Г42	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(1.30 \pm 0.19) \times 10^{-3}$		DESIG=17
Г43	$K^+ K^- \pi^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=36
Г44	$K^+ K^- \eta$	$< 3.3 \times 10^{-4}$	CL=90%	DESIG=40
Г45	$K^+ K^- \eta'(958)$	$(1.94 \pm 0.34) \times 10^{-4}$		DESIG=82
Г46	$\eta \eta'$	$(2.2 \pm 0.5) \times 10^{-5}$		DESIG=34
Г47	$\eta' \eta'$	$(4.6 \pm 0.6) \times 10^{-5}$		DESIG=35
Г48	$\pi^+ \pi^- K_S^0 K_S^0$	$(2.2 \pm 0.5) \times 10^{-3}$		DESIG=29
Г49	$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=30
Г50	$K_S^0 K_S^0 K_S^0 K_S^0$	$(1.15 \pm 0.18) \times 10^{-4}$		DESIG=97
Г51	$K^+ K^- K^+ K^-$	$(1.67 \pm 0.22) \times 10^{-3}$	S=1.1	DESIG=24
Г52	$K^+ K^- \phi$	$(1.45 \pm 0.30) \times 10^{-3}$		DESIG=32
Г53	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		DESIG=83
Г54	$K^+ K^- \pi^0 \phi$	$(2.7 \pm 0.5) \times 10^{-3}$		DESIG=84
Г55	$\phi \pi^+ \pi^- \pi^0$	$(9.3 \pm 1.2) \times 10^{-4}$		DESIG=80
Г56	$p \bar{p}$	$(7.3 \pm 0.4) \times 10^{-5}$	S=1.1	DESIG=11
Г57	$p \bar{p} \pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$		DESIG=37
Г58	$p \bar{p} \eta$	$(1.77 \pm 0.25) \times 10^{-4}$		DESIG=41
Г59	$p \bar{p} \omega$	$(3.7 \pm 0.4) \times 10^{-4}$		DESIG=61
Г60	$p \bar{p} \phi$	$(2.8 \pm 0.9) \times 10^{-5}$		DESIG=66
Г61	$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		DESIG=8
Г62	$p \bar{p} \pi^0 \pi^0$	$(8.0 \pm 2.4) \times 10^{-4}$		DESIG=53
Г63	$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.94 \pm 0.33) \times 10^{-4}$		DESIG=63
Г64	$p \bar{p} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	CL=90%	DESIG=28
Г65	$p \bar{n} \pi^-$	$(8.7 \pm 1.0) \times 10^{-4}$		DESIG=31
Г66	$\bar{p} n \pi^+$	$(9.1 \pm 0.8) \times 10^{-4}$		DESIG=75
Г67	$p \bar{n} \pi^- \pi^0$	$(2.21 \pm 0.18) \times 10^{-3}$		DESIG=76
Г68	$\bar{p} n \pi^+ \pi^0$	$(2.15 \pm 0.19) \times 10^{-3}$		DESIG=77
Г69	$\Lambda \bar{\Lambda}$	$(1.86 \pm 0.16) \times 10^{-4}$		DESIG=19
Г70	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.28 \pm 0.16) \times 10^{-3}$		DESIG=27
Г71	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(6.7 \pm 1.5) \times 10^{-4}$		DESIG=70
Г72	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	CL=90%	DESIG=71
Г73	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	CL=90%	DESIG=72
Г74	$\Lambda \bar{\Lambda} \eta$	$(1.07 \pm 0.26) \times 10^{-4}$		DESIG=105
Г75	$K^+ \bar{p} \Lambda + \text{c.c.}$	$(7.9 \pm 0.6) \times 10^{-4}$		DESIG=38
Г76	$n K_S^0 \bar{\Lambda} + \text{c.c.}$	$(3.64 \pm 0.29) \times 10^{-4}$		DESIG=104
Г77	$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(8.3 \pm 1.2) \times 10^{-4}$		DESIG=101
Г78	$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=64
Г79	$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.7 \pm 1.5) \times 10^{-4}$		DESIG=65
Г80	$\Sigma^0 \bar{\Sigma}^0$	$(3.7 \pm 0.6) \times 10^{-5}$		DESIG=47
Г81	$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(8.4 \pm 1.0) \times 10^{-5}$		DESIG=100
Г82	$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(9.3 \pm 0.8) \times 10^{-5}$		DESIG=103
Г83	$\Sigma^+ \bar{\Sigma}^-$	$(3.4 \pm 0.7) \times 10^{-5}$		DESIG=48
Г84	$\Sigma^- \bar{\Sigma}^+$	$(4.5 \pm 1.8) \times 10^{-5}$		DESIG=102
Г85	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=73
Г86	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	CL=90%	DESIG=74
Г87	$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.80 \pm 0.32) \times 10^{-4}$		DESIG=85
Г88	$\Xi^0 \Xi^0$	$(1.86 \pm 0.22) \times 10^{-4}$		DESIG=49
Г89	$\Xi^- \Xi^+$	$(1.46 \pm 0.12) \times 10^{-4}$		DESIG=26
Г90	$\Omega^- \bar{\Omega}^+$	$(4.52 \pm 0.30) \times 10^{-5}$		DESIG=106
Г91	$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	CL=90%	DESIG=12
Г92	$\pi^0 \eta_c$	$< 3.2 \times 10^{-3}$	CL=90%	DESIG=81
Г93	$\eta_c(1S) \pi^+ \pi^-$	$< 5.4 \times 10^{-3}$	CL=90%	DESIG=69

Radiative decays

Г94	$\gamma J/\psi(1S)$	$(19.5 \pm 0.8) \%$	S=1.5	NODE=M057;CLUMP=B DESIG=6
Г95	$\gamma \rho^0$	$< 1.9 \times 10^{-5}$	CL=90%	DESIG=44
Г96	$\gamma \omega$	$< 6 \times 10^{-6}$	CL=90%	DESIG=45
Г97	$\gamma \phi$	$< 8 \times 10^{-6}$	CL=90%	DESIG=46
Г98	$\gamma \gamma$	$(2.92 \pm 0.12) \times 10^{-4}$	S=1.3	DESIG=7
Г99	$e^+ e^- J/\psi(1S)$	$(2.20 \pm 0.15) \times 10^{-3}$		DESIG=86
Г100	$\mu^+ \mu^- J/\psi(1S)$	$(2.07 \pm 0.34) \times 10^{-4}$		DESIG=98

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 86 branching ratios uses 253 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 389.6$ for 204 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{14}	7									
x_{17}	2	26								
x_{18}	2	2	0							
x_{20}	4	4	1	1						
x_{25}	4	4	1	2	5					
x_{26}	26	2	1	1	1	1				
x_{31}	2	2	0	1	3	16	1			
x_{32}	3	3	1	1	2	7	1	3		
x_{33}	3	3	1	1	3	16	1	9	4	
x_{42}	1	1	0	1	2	8	0	5	2	5
x_{51}	3	3	1	1	3	9	1	5	3	5
x_{56}	6	6	1	2	4	12	2	6	4	7
x_{69}	2	2	0	1	3	15	0	8	3	8
x_{94}	12	12	3	3	9	25	4	13	8	15
x_{98}	-10	-10	-3	-1	-3	19	-3	12	1	9
Γ	-18	-18	-5	-5	-12	-26	-6	-13	-10	-16
	x_1	x_{14}	x_{17}	x_{18}	x_{20}	x_{25}	x_{26}	x_{31}	x_{32}	x_{33}

x_{51}	3				
x_{56}	4	5			
x_{69}	4	4	6		
x_{94}	7	10	-12	12	
x_{98}	6	2	27	11	11
Γ	-8	-12	-42	-13	-48
	x_{42}	x_{51}	x_{56}	x_{69}	x_{94}

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M057220

NODE=M057223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{56} \Gamma_{94} / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
28.0 ± 1.3 OUR FIT	Error includes scale factor of 1.1.	[27.5 ± 1.2 eV OUR 2023 FIT]	
27.5 ± 1.5 OUR AVERAGE			

NODE=M057G1
NODE=M057G1
NEW

27.0 ± 1.5 ± 1.1	¹ ANDREOTTI 05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
27.7 ± 1.5 ± 2.0	^{1,2} ARMSTRONG 92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
36 ± 8	¹ BAGLIN 86B SPEC	$\bar{p}p \rightarrow e^+ e^- X$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

² Recalculated by ANDREOTTI 05A.

NODE=M057G;LINKAGE=7A
NODE=M057G;LINKAGE=AN

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{98} \Gamma_{94} / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
113 ± 5 OUR FIT	Error includes scale factor of 1.3.	[107 ± 5 eV OUR 2023 FIT]		
123 ± 6 OUR AVERAGE				
[117 ± 10 eV OUR 2023 AVERAGE]				

NODE=M057G2
NODE=M057G2
NEW
NEW

124.1 ± 2.5 ± 5.9	4960	¹ SEINO 23 BELL	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
111 ± 12 ± 9	147	² DOBBS 06 CLE3	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$
139 ± 55 ± 21		^{2,3} ACCIARRI 99E L3	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

242 ± 65 ± 51	2,4 ACKER.,K...	98	OPAL	$e^+e^- \rightarrow e^+e^- \chi_{c2}$
150 ± 42 ± 36	2,5 DOMINICK	94	CLE2	$e^+e^- \rightarrow e^+e^- \chi_{c2}$
470 ± 240 ± 120	2,6 BAUER	93	TPC	$e^+e^- \rightarrow e^+e^- \chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

114 ± 11 ± 9	136	2,7 ABE	02T	BELL	$e^+e^- \rightarrow e^+e^- \chi_{c2}$

¹ Calculated from the measured $\Gamma_{\gamma\gamma} \times B(\chi_{c2}(1S) \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 14.8 \pm 0.3 \pm 0.7$ eV, using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 11.93 \pm 0.05\%$.

² Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1187 \pm 0.0008$.

³ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACCIARRI 99E is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) \times B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.0162 \pm 0.0014$.

⁴ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in ACKERSTAFF, K 98 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1203 \pm 0.0038$.

⁵ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in DOMINICK 94 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

⁶ The value for $\Gamma(\chi_{c2} \rightarrow \gamma\gamma)$ reported in BAUER 93 is derived using $B(\chi_{c2} \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$, $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0627 \pm 0.0020$, and $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

⁷ All systematic errors added in quadrature. Superseded by SEINO 23.

———— $\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$ ————

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_{98} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

5.8 ± 0.7 OUR FIT Error includes scale factor of 1.4. [5.7 ± 0.5 eV OUR 2023 FIT]

5.2 ± 0.7 OUR AVERAGE

5.01 ± 0.44 ± 0.55	1597 ± 138	UEHARA	08	BELL	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$
6.4 ± 1.8 ± 0.8		EISENSTEIN	01	CLE2	$e^+e^- \rightarrow e^+e^- \chi_{c2}$

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 7.8 90 < 598 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{14} \Gamma_{98} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.8 ± 0.6 OUR FIT Error includes scale factor of 1.2. [4.7 ± 0.5 eV OUR 2023 FIT]

4.42 ± 0.42 ± 0.53 780 ± 74 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{15} \Gamma_{98} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

6.5 ± 0.9 ± 1.5 1250 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{18} \Gamma_{98} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.3 ± 0.5 OUR FIT Error includes scale factor of 2.3. [1.26 ± 0.24 eV OUR 2023 FIT]

0.8 ± 0.17 ± 0.27 151 ± 30 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{20} \Gamma_{98} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.71 ± 0.05 OUR FIT Error includes scale factor of 1.5. [0.60 ± 0.05 eV OUR 2023 FIT]

0.62 ± 0.07 ± 0.05 89 ± 11 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(K^+K^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.58 ± 0.18 ± 0.16 26.5 ± 8.1 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+K^-)$

¹ Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_{22} \Gamma_{98} / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.64 90 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G2;LINKAGE=A

NODE=M057G;LINKAGE=LL

NODE=M057G;LINKAGE=J4

NODE=M057G;LINKAGE=J5

NODE=M057G;LINKAGE=J6

NODE=M057G;LINKAGE=J7

NODE=M057G;LINKAGE=GT

NODE=M057224

NODE=M057G3

NODE=M057G3

NEW

NODE=M057G08

NODE=M057G08

NODE=M057G09

NODE=M057G09

NEW

NODE=M057G02

NODE=M057G02

NODE=M057G10

NODE=M057G10

NEW

NODE=M057G12

NODE=M057G12

NEW

NODE=M057G12;LINKAGE=LI

NODE=M057G03

NODE=M057G03

NODE=M057G03;LINKAGE=LI

$$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{98}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.04 90 ¹ LIU 12B BELL $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M057G04
NODE=M057G04

NODE=M057G04;LINKAGE=LI

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.31±0.08 OUR FIT Error includes scale factor of 1.2. [1.25 ± 0.07 eV OUR 2023 FIT]

1.18±0.25 OUR AVERAGE

1.44±0.54±0.47 34 ± 13 ¹ UEHARA 09 BELL 10.6 e⁺e⁻ → e⁺e⁻π⁰π⁰
1.14±0.21±0.17 54 ± 10 ² NAKAZAWA 05 BELL 10.6 e⁺e⁻ → e⁺e⁻π⁺π⁻

¹ We multiplied the measurement by 3 to convert from π⁰π⁰ to ππ. Interference with the continuum included.

² We have multiplied π⁺π⁻ measurement by 3/2 to obtain ππ.

NODE=M057G4
NODE=M057G4
NEW

NODE=M057G4;LINKAGE=UE

NODE=M057G;LINKAGE=NA

$$\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

2.1±0.9 OUR FIT

3.2±1.9±0.5 986 ± 578 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$

NODE=M057G07
NODE=M057G07

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{31}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.53±0.22±0.09 8 ¹ UEHARA 10A BELL 10.6 e⁺e⁻ → e⁺e⁻ηη

¹ Interference with the continuum not included.

NODE=M057G13
NODE=M057G13

NODE=M057G13;LINKAGE=UE

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{32}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.59±0.09 OUR FIT Error includes scale factor of 2.1. [0.56 ± 0.04 eV OUR 2023 FIT]

0.44±0.11±0.07 33 ± 8 NAKAZAWA 05 BELL 10.6 e⁺e⁻ → e⁺e⁻K⁺K⁻

NODE=M057G5
NODE=M057G5
NEW

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{33}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.307±0.026 OUR FIT Error includes scale factor of 1.1. [0.294 ± 0.025 eV OUR 2023 FIT]

0.27 ^{+0.07}_{-0.06} ±0.03 53 ¹ UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.31 ± 0.05 ± 0.03 38 ± 7 CHEN 07B BELL e⁺e⁻ → e⁺e⁻χ_{c2}

¹ Supersedes CHEN 07B.

NODE=M057G6
NODE=M057G6
NEW

NODE=M057G6;LINKAGE=UE

$$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.75±0.11 OUR FIT

[0.72 ± 0.11 eV OUR 2023 FIT]

1.20±0.33±0.13 126 ¹ DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹ We have multiplied $\bar{K}^0 K \pi$ by 2/3 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$

NODE=M057G01
NODE=M057G01
NEW

NODE=M057G01;LINKAGE=DE

$$\Gamma(K^+ K^- K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_{98}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.97±0.13 OUR FIT Error includes scale factor of 1.1. [0.93 ± 0.11 eV OUR 2023 FIT]

1.10±0.21±0.15 126 ± 24 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(K^+ K^-)$

NODE=M057G11
NODE=M057G11
NEW

$$\Gamma(\eta_c(1S)\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{93}\Gamma_{98}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<15.7 90 LEES 12AE BABR e⁺e⁻ → e⁺e⁻π⁺π⁻η_c

NODE=M057G05
NODE=M057G05

χ_{c2}(1P) BRANCHING RATIOS

NODE=M057225

HADRONIC DECAYS

NODE=M057305

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-)) \quad \Gamma_{26}/\Gamma_1$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.36±0.15 OUR FIT

[0.36 ± 0.15 OUR 2023 FIT]

0.31±0.17 TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R38
NODE=M057R38
NEW

$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.24 OUR AVERAGE		[(1.83 ± 0.23)% OUR 2023 AVERAGE]		
1.86±0.23±0.05	903.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.87 \pm 0.07 \pm 0.22 \pm 0.13$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46
NODE=M057R46

NEW

NODE=M057R46;LINKAGE=HE

 $\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.22±0.35 OUR AVERAGE		[(2.19 ± 0.34)% OUR 2023 AVERAGE]		
2.22±0.34±0.05	1031.9	^{1,2} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $2.23 \pm 0.11 \pm 0.32 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

NODE=M057R47
NODE=M057R47

NEW

NODE=M057R47;LINKAGE=HE

NODE=M057R47;LINKAGE=OC

 $\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.13±0.15 OUR AVERAGE		[(1.11 ± 0.15) $\times 10^{-3}$ OUR 2023 AVERAGE]		
1.13±0.15±0.03	1164	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ABLIKIM 11A reports $(1.21 \pm 0.05 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58
NODE=M057R58

NEW

NODE=M057R58;LINKAGE=AB

 $\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.21±0.04±0.01	76.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.21 \pm 0.03 \pm 0.03 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48
NODE=M057R48

NODE=M057R48;LINKAGE=HE

 $\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.41±0.20 OUR AVERAGE		[(1.38 ± 0.20)% OUR 2023 AVERAGE]		
1.41±0.20±0.03	211.6	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.41 \pm 0.11 \pm 0.16 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50
NODE=M057R50

NEW

NODE=M057R50;LINKAGE=HE

 $\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.42±0.13 OUR AVERAGE		[(0.41 ± 0.12)% OUR 2023 AVERAGE]		
0.42±0.13±0.01	62.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.42 \pm 0.11 \pm 0.06 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51
NODE=M057R51

NEW

NODE=M057R51;LINKAGE=HE

$$\Gamma(K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.08 OUR AVERAGE		[(0.29 ± 0.08)% OUR 2023 AVERAGE]		
0.30±0.08±0.01	38.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 K^- \pi^+ \rightarrow K^- \pi^+ K^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57
NODE=M057R57
NEW

NODE=M057R57;LINKAGE=HE

$$\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.39±0.09 OUR AVERAGE		[(0.38 ± 0.09)% OUR 2023 AVERAGE]		
0.39±0.09±0.01	63.0	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.39 \pm 0.07 \pm 0.05 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52
NODE=M057R52
NEW

NODE=M057R52;LINKAGE=HE

$$\Gamma(K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.38±0.08 OUR AVERAGE		[(0.37 ± 0.08)% OUR 2023 AVERAGE]		
0.38±0.08±0.01	51.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.38 \pm 0.07 \pm 0.04 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53
NODE=M057R53
NEW

NODE=M057R53;LINKAGE=HE

$$\Gamma(K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.30±0.08 OUR AVERAGE		[(0.29 ± 0.08)% OUR 2023 AVERAGE]		
0.30±0.08±0.01	39.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.30 \pm 0.07 \pm 0.04 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{K}^0 \pi^- \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54
NODE=M057R54
NEW

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.130±0.045±0.003	22.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.13 \pm 0.04 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55
NODE=M057R55

NODE=M057R55;LINKAGE=HE

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{15}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.69±0.13±1.31	11k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R00
NODE=M057R00

NODE=M057R00;LINKAGE=A

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.30±0.11±0.75	4.5k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R73
NODE=M057R73

NODE=M057R73;LINKAGE=A

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma(K^+ K^- \pi^+ \pi^-) \quad \Gamma_{17}/\Gamma_{14}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.25±0.13 OUR FIT			
0.25±0.13	TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R39
NODE=M057R39

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

15.3±1.9 OUR AVERAGE Error includes scale factor of 3.8. $[(15.2 \pm 1.7) \times 10^{-3}$ OUR 2023 AVERAGE Scale factor = 3.7]

15.9±0.4±0.4	112K	¹ ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+\pi^-)$
8.6±0.9±1.6		² BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
8.7±5.9±0.4		² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ ABLIKIM 22Q reports $(1.565 \pm 0.005 \pm 0.048) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Rescaled by us using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+\pi^-$ to $K^0 K^+\pi^-$ decay.

NODE=M057R4
NODE=M057R4

NEW

NODE=M057R4;LINKAGE=A

NODE=M057R;LINKAGE=X3

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

1.23 ±0.07 OUR FIT Error includes scale factor of 1.9. $[(1.06 \pm 0.09) \times 10^{-3}$ OUR 2023 FIT]

1.27 ±0.04 OUR AVERAGE $[(1.9 \pm 0.7) \times 10^{-3}$ OUR 2006 AVERAGE]

1.267±0.028±0.033	4247	¹ ABLIKIM	23N BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ Measured using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$ and $B(\phi \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$ from PDG 22.

NODE=M057R20
NODE=M057R20

NEW

NEW

NODE=M057R20;LINKAGE=A

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

5.4±0.7 OUR AVERAGE $[(5.3 \pm 0.6) \times 10^{-4}$ OUR 2023 AVERAGE]

5.4±0.7±0.1	143.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma \phi\phi\eta$

¹ ABLIKIM 20B reports $(5.33 \pm 0.52 \pm 0.39) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R97
NODE=M057R97

NEW

NODE=M057R97;LINKAGE=A

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

0.86±0.10 OUR AVERAGE $[(0.84 \pm 0.10) \times 10^{-3}$ OUR 2023 AVERAGE]

0.83±0.10±0.02	762	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons
1.76±0.58±0.04	27.7 ± 7.4	² ABLIKIM	05N BES2	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma 6\pi$

¹ ABLIKIM 11K reports $(8.9 \pm 0.3 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 05N reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.165 \pm 0.044 \pm 0.032) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R28
NODE=M057R28

NEW

NODE=M057R28;LINKAGE=AL

NODE=M057R28;LINKAGE=AB

 $\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

0.73±0.04±0.08	512	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R74
NODE=M057R74

NODE=M057R74;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

9.7±2.8 OUR AVERAGE $[(9.6 \pm 2.7) \times 10^{-6}$ OUR 2023 AVERAGE]

9.7±2.8±0.2	33	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	^{2,3} ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

NODE=M057R63
NODE=M057R63

NEW

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.91 \pm 0.23 \pm 0.12) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R63;LINKAGE=A

² ABLIKIM 11K reports $< 2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

NODE=M057R63;LINKAGE=AL

³ Superseded by ABLIKIM 19J.

NODE=M057R63;LINKAGE=B

$\Gamma(\pi^+\pi^-\pi^0(\text{non-resonant}))/\Gamma_{\text{total}}$

 Γ_{27}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.0±0.4±0.1	64	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M057R84
NODE=M057R84

OCCUR=2

¹ ABLIKIM 17AG reports $(2.1 \pm 0.4 \pm 0.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\pi^0(\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R84;LINKAGE=B

$\Gamma(\rho(770)^\pm\pi^\mp)/\Gamma_{\text{total}}$

 Γ_{28}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
0.62±0.39±0.02	15	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M057R85
NODE=M057R85

¹ ABLIKIM 17AG reports $(0.64 \pm 0.39 \pm 0.07) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \rho(770)^\pm\pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R85;LINKAGE=A

$\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$

 Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
0.49±0.13 OUR AVERAGE		[(0.48 ± 0.13) × 10 ⁻³ OUR 2023 AVERAGE]		

NODE=M057R08
NODE=M057R08

NEW

0.49±0.13±0.01 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5 90 ² ABLIKIM 06R BES2 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ ATHAR 07 reports $(0.49 \pm 0.12 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R08;LINKAGE=AT

² ABLIKIM 06R reports $< 1.7 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

NODE=M057R08;LINKAGE=AB

$\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$

 Γ_{30}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.51±0.19 OUR AVERAGE	[(0.50 ± 0.18) × 10 ⁻³ OUR 2023 AVERAGE]		

NODE=M057R35
NODE=M057R35

NEW

0.51±0.19±0.01 ¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.51 \pm 0.18 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R35;LINKAGE=AT

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$

 Γ_{34}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.46±0.21 OUR AVERAGE	[(1.44 ± 0.21) × 10 ⁻⁴ OUR 2023 AVERAGE]		

NODE=M057R86
NODE=M057R86

NEW

1.46±0.21±0.04 ¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.75±0.27±0.04 ² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

OCCUR=2

1.36±0.27±0.03 ³ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

OCCUR=3

- ¹ ABLIKIM 17AG reports $(1.5 \pm 0.1 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 17AG reports $(1.8 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ ABLIKIM 17AG reports $(1.4 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R86;LINKAGE=A

NODE=M057R86;LINKAGE=B

NODE=M057R86;LINKAGE=C

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ **Γ_{35}/Γ**

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.27±0.27 OUR AVERAGE	[(1.24 ± 0.27) × 10 ⁻⁴ OUR 2023 AVERAGE]		
1.27±0.27±0.03	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057R87
NODE=M057R87

NEW

- ¹ ABLIKIM 17AG reports $(1.3 \pm 0.2 \pm 0.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R87;LINKAGE=A

 $\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$ **Γ_{36}/Γ**

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
15.1±1.3 OUR AVERAGE	[(14.8 ± 1.2) × 10 ⁻⁴ OUR 2023 AVERAGE]		
15.1±1.2±0.4	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K \bar{K} \pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
17.7±1.6±0.4	² ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$
13.2±1.5±0.3	³ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057R88
NODE=M057R88

NEW

- ¹ ABLIKIM 17AG reports $(15.5 \pm 0.6 \pm 1.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 17AG reports $(18.2 \pm 0.8 \pm 1.6) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ³ ABLIKIM 17AG reports $(13.6 \pm 0.8 \pm 1.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R88;LINKAGE=A

NODE=M057R88;LINKAGE=B

NODE=M057R88;LINKAGE=C

 $\Gamma(K_2^*(1430)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ **Γ_{37}/Γ**

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
12.7±1.7 OUR AVERAGE	[(12.4 ± 1.7) × 10 ⁻⁴ OUR 2023 AVERAGE]		
12.7±1.7±0.3	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M057R89
NODE=M057R89

NEW

- ¹ ABLIKIM 17AG reports $(13.0 \pm 1.0 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_2^*(1430)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R89;LINKAGE=A

$\Gamma(K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{38}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

5.3±0.8 OUR AVERAGE $[(5.2 \pm 0.8) \times 10^{-4}]$ OUR 2023 AVERAGE]**5.3±0.8±0.1**¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.2±1.0±0.1

² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

5.7±1.8±0.1

³ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

¹ ABLIKIM 17AG reports $(5.4 \pm 0.5 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 17AG reports $(5.3 \pm 0.5 \pm 0.9) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 17AG reports $(5.9 \pm 1.1 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^\pm K^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R90
NODE=M057R90

NEW

OCCUR=2

OCCUR=3

NODE=M057R90;LINKAGE=A

NODE=M057R90;LINKAGE=B

NODE=M057R90;LINKAGE=C

 $\Gamma(K_3^*(1780)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{39}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

5.7±2.1 OUR AVERAGE $[(5.6 \pm 2.1) \times 10^{-4}]$ OUR 2023 AVERAGE]**5.7±2.1±0.1**¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

¹ ABLIKIM 17AG reports $(5.9 \pm 1.6 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K_3^*(1780)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R91
NODE=M057R91

NEW

NODE=M057R91;LINKAGE=A

 $\Gamma(a_2(1320)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

13.1±3.5 OUR AVERAGE $[(12.9 \pm 3.4) \times 10^{-4}]$ OUR 2023 AVERAGE]**13.1±3.5±0.3**¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

¹ ABLIKIM 17AG reports $(13.5 \pm 1.6 \pm 3.2) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow a_2(1320)^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R92
NODE=M057R92

NEW

NODE=M057R92;LINKAGE=A

 $\Gamma(a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{41}/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

17.9±6.2±0.4¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

¹ ABLIKIM 17AG reports $(18.4 \pm 3.3 \pm 5.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow a_2(1320)^\pm \pi^\mp)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R93
NODE=M057R93

NODE=M057R93;LINKAGE=A

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

0.31±0.08 OUR AVERAGE $[(0.30 \pm 0.08) \times 10^{-3}]$ OUR 2023 AVERAGE]**0.31±0.08±0.01**¹ ATHAR 07 CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.31 \pm 0.07 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R05
NODE=M057R05

NEW

NODE=M057R05;LINKAGE=AT

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.33 (CL = 90%)		[<0.32 $\times 10^{-3}$ (CL = 90%) OUR 2023 BEST LIMIT]		
<0.33	90	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ATHAR 07 reports $< 0.33 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.				

NODE=M057R09
 NODE=M057R09

NODE=M057R09;LINKAGE=AT

 $\Gamma(K^+ K^- \eta'(958))/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.94$\pm$0.34	107	¹ ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$
¹ Derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.72 \pm 0.34)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.				

NODE=M057R78
 NODE=M057R78

NODE=M057R78;LINKAGE=A

 $\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2$\pm$0.5$\pm$0.1		20	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 6	90	3.3 $\pm$ 8.0	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta \eta'$
<23	90		³ ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
¹ ABLIKIM 17AI reports $(2.27 \pm 0.43 \pm 0.25) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² ASNER 09 reports $< 0.6 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					
³ Superseded by ASNER 09. ADAMS 07 reports $< 2.3 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

NODE=M057R03
 NODE=M057R03

NODE=M057R03;LINKAGE=A

NODE=M057R03;LINKAGE=AS

NODE=M057R03;LINKAGE=AD

 $\Gamma(\eta' \eta')/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.6$\pm$0.6$\pm$0.1		60	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma \eta' \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<10	90	12 $\pm$ 7	² ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma \eta' \eta'$
<31	90		³ ADAMS	07 CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
¹ ABLIKIM 17AI reports $(4.76 \pm 0.56 \pm 0.38) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² ASNER 09 reports $< 1.0 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					
³ Superseded by ASNER 09. ADAMS 07 reports $< 3.1 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \eta' \eta')/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0933 \pm 0.0014 \pm 0.0061$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

NODE=M057R04
 NODE=M057R04

NODE=M057R04;LINKAGE=A

NODE=M057R04;LINKAGE=AS

NODE=M057R04;LINKAGE=AD

 $\Gamma(\pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2$\pm$0.5$\pm$0.1	57 $\pm$ 11	¹ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$
¹ ABLIKIM 05o reports $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ = $(0.207 \pm 0.039 \pm 0.033) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R31
 NODE=M057R31

NODE=M057R31;LINKAGE=AB

$\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 $\pm$ 2.2	¹ ABLIKIM	050 BES2	$e^+ e^- \rightarrow \chi_{c2} \gamma$
¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] < 3.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

NODE=M057R32
NODE=M057R32

NODE=M057R32;LINKAGE=AB

 $\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.15$\pm$0.18 OUR AVERAGE				[(1.13 $\pm$ 0.18) $\times 10^{-4}$ OUR 2023 AVERAGE]
1.15$\pm$0.18$\pm$0.03	68	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$

NODE=M057R94
NODE=M057R94

NEW

NODE=M057R94;LINKAGE=A

¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (10.8 \pm 1.5 \pm 0.8) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.45$\pm$0.30 OUR AVERAGE				[(1.42 $\pm$ 0.29) $\times 10^{-3}$ OUR 2023 AVERAGE]
1.45$\pm$0.30$\pm$0.04	52	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M057R01
NODE=M057R01

NEW

NODE=M057R01;LINKAGE=AB

¹ ABLIKIM 06T reports $(1.67 \pm 0.26 \pm 0.24) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.83$\pm$0.32$\pm$0.66	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R79
NODE=M057R79

 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.74$\pm$0.16$\pm$0.44	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R80
NODE=M057R80

 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.93$\pm$0.06$\pm$0.10	408	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R75
NODE=M057R75

NODE=M057R75;LINKAGE=A

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

 $\Gamma(p \bar{p} \pi^0)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.47$\pm$0.04 OUR AVERAGE			
0.48 $\pm$ 0.04 $\pm$ 0.01	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$
0.44 $\pm$ 0.09 $\pm$ 0.01	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R06
NODE=M057R06

NODE=M057R06;LINKAGE=ON

¹ ONYISI 10 reports $(4.83 \pm 0.25 \pm 0.35 \pm 0.31) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $(0.44 \pm 0.08 \pm 0.05) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=AT

 $\Gamma(p \bar{p} \eta)/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.177$\pm$0.025 OUR AVERAGE			
			[(0.174 $\pm$ 0.025) $\times 10^{-3}$ OUR 2023 AVERAGE]
0.175 $\pm$ 0.027 $\pm$ 0.004	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p \bar{p} X$
0.189 $\pm$ 0.071 $\pm$ 0.005	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R34
NODE=M057R34

NEW

¹ ONYISI 10 reports $(1.76 \pm 0.23 \pm 0.14 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=ON

² ATHAR 07 reports $(0.19 \pm 0.07 \pm 0.02) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R34;LINKAGE=AT

 $\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{59}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

0.37±0.04 OUR AVERAGE $[(0.36 \pm 0.04) \times 10^{-3}]$ OUR 2023 AVERAGE]

0.37±0.04±0.01 ¹ ONYISI 10 CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$

¹ ONYISI 10 reports $(3.68 \pm 0.35 \pm 0.26 \pm 0.24) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R56
NODE=M057R56

NEW

NODE=M057R56;LINKAGE=ON

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{60}/Γ**

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT

2.8±0.9±0.1 24 ± 7 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(3.04 \pm 0.85 \pm 0.43) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R62
NODE=M057R62

NODE=M057R62;LINKAGE=AB

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ **Γ_{61}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

1.32±0.34 OUR EVALUATION Treating systematic error as correlated.

1.3 ±0.4 OUR AVERAGE Error includes scale factor of 1.3.

1.17±0.19±0.30 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c2}$

2.64±1.03±0.14 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c2}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.3 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. Multiplied by a factor of 2 to convert from $K_S^0 K^+ \pi^-$ to $K^0 K^+ \pi^-$ decay.

NODE=M057R6
NODE=M057R6

→ UNCHECKED ←

NODE=M057R6;LINKAGE=X3

 $\Gamma(p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ **Γ_{62}/Γ**

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

0.080±0.024 OUR AVERAGE $[(0.078 \pm 0.023)\%]$ OUR 2023 AVERAGE]

0.080±0.024±0.002 29.2 ¹ HE 08B CLEO $e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.08 \pm 0.02 \pm 0.01 \pm 0.01\%$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R49
NODE=M057R49

NEW

NODE=M057R49;LINKAGE=HE

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ **Γ_{63}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

1.94±0.33 OUR AVERAGE $[(1.91 \pm 0.32) \times 10^{-4}]$ OUR 2023 AVERAGE]

1.94±0.32±0.05 131 ± 12 ¹ ABLIKIM 11F BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

¹ ABLIKIM 11F reports $(2.08 \pm 0.19 \pm 0.30) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R59
NODE=M057R59

NEW

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0 K_S^0)/\Gamma_{\text{total}}$ **Γ_{64}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<7.9 90 ¹ ABLIKIM 06D BES2 $\psi(2S) \rightarrow \chi_{c2}\gamma$

¹ Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R30
NODE=M057R30

NODE=M057R;LINKAGE=AB

$\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.7±1.0 OUR AVERAGE				
[(8.5 ± 0.9) × 10 ⁻⁴ OUR 2023 AVERAGE]				
8.5±1.0±0.2	3309	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
10.4±3.5±0.3		² ABLIKIM	06I BES2	$\psi(2S) \rightarrow \gamma p\pi^- X$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.80 \pm 0.02 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 06I reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.97 \pm 0.20 \pm 0.26) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R33
NODE=M057R33
NEW

NODE=M057R33;LINKAGE=AL

NODE=M057R33;LINKAGE=AB

 $\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±0.8 OUR AVERAGE				
[(8.9 ± 0.8) × 10 ⁻⁴ OUR 2023 AVERAGE]				
9.1±0.8±0.2	3732	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.85 \pm 0.02 \pm 0.07) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R70
NODE=M057R70
NEW

NODE=M057R70;LINKAGE=AL

 $\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
22.1±1.8 OUR AVERAGE				
[(21.7 ± 1.8) × 10 ⁻⁴ OUR 2023 AVERAGE]				
22.1±1.7±0.5	2128	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (2.07 \pm 0.06 \pm 0.15) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R71
NODE=M057R71
NEW

NODE=M057R71;LINKAGE=AL

 $\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.5±1.9 OUR AVERAGE				
[(21.1 ± 1.8) × 10 ⁻⁴ OUR 2023 AVERAGE]				
21.5±1.8±0.5	2352	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c2}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (2.01 \pm 0.06 \pm 0.16) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R72
NODE=M057R72
NEW

NODE=M057R72;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
128±16 OUR AVERAGE					
[(125 ± 15) × 10 ⁻⁵ OUR 2023 AVERAGE]					
128±15±3		371	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<350	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c2}\gamma$

¹ ABLIKIM 12I reports $(137.0 \pm 7.6 \pm 15.7) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (9.3 \pm 0.6)\%$.

NODE=M057R29
NODE=M057R29
NEW

NODE=M057R29;LINKAGE=AL

NODE=M057R29;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
67±15 OUR AVERAGE				
[(66 ± 15) × 10 ⁻⁵ OUR 2023 AVERAGE]				
67±15±2	36	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 12I reports $(71.8 \pm 14.5 \pm 8.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R65
NODE=M057R65

NEW

NODE=M057R65;LINKAGE=AL

$\Gamma(\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<40	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Lambda} \pi^-$
¹ ABLIKIM 12I reports $< 42 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.				

NODE=M057R66
 NODE=M057R66

NODE=M057R66;LINKAGE=AL

 $\Gamma(\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<60	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Lambda} \pi^+$
¹ ABLIKIM 12I reports $< 61 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.				

NODE=M057R67
 NODE=M057R67

NODE=M057R67;LINKAGE=AL

 $\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.9±0.6 OUR AVERAGE				
[(7.8 ± 0.5) × 10 ⁻⁴ OUR 2023 AVERAGE]				
7.8±0.5±0.2	5k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
8.5±1.6±0.2		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
¹ ABLIKIM 13D reports $(8.4 \pm 0.3 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.				
³ ATHAR 07 reports $(8.5 \pm 1.4 \pm 1.0) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R07
 NODE=M057R07

NEW

NODE=M057R07;LINKAGE=AB

NODE=M057R07;LINKAGE=LB
 NODE=M057R07;LINKAGE=AT

 $\Gamma(n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.64±0.29 OUR AVERAGE				
[(3.58 ± 0.28) × 10 ⁻⁴ OUR 2023 AVERAGE]				
3.64±0.27±0.09	879	¹ ABLIKIM	21AV BES3	$\psi(2S) \rightarrow \gamma n K_S^0 \bar{\Lambda} + \text{c.c.}$
¹ ABLIKIM 21AV reports $(3.58 \pm 0.16 \pm 0.23) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow n K_S^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 0.0952 \pm 0.0020$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Also uses $B(\bar{\Lambda} \rightarrow \bar{p} \pi^+) = (63.9 \pm 0.5)\%$ and $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$.				

NODE=M057P01
 NODE=M057P01

NEW

NODE=M057P01;LINKAGE=B

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.3±1.2 OUR AVERAGE				
[(8.2 ± 1.1) × 10 ⁻⁴ OUR 2023 AVERAGE]				
8.3±1.2±0.2	476	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$
¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.9 \pm 0.6) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R98
 NODE=M057R98

NEW

NODE=M057R98;LINKAGE=F

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.7 OUR AVERAGE				
[(2.8 ± 0.7) × 10 ⁻⁴ OUR 2023 AVERAGE]				
2.9±0.7±0.1	79 ± 13	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$
¹ ABLIKIM 11F reports $(3.06 \pm 0.50 \pm 0.54) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R60
 NODE=M057R60

NEW

NODE=M057R60;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.7±1.5 OUR AVERAGE			[(4.6 ± 1.5) × 10 ⁻⁴ OUR 2023 AVERAGE]		
4.7±1.5±0.1		29 ± 7	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports (5.05 ± 1.29 ± 0.93) × 10⁻⁴ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R61
NODE=M057R61

NEW

NODE=M057R61;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.7±0.6±0.1		91	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
<7	90	7.5 ± 3.4	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.35 \pm 0.05 \pm 0.02) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13H reports < 0.65 × 10⁻⁴ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

³ NAIK 08 reports < 0.75 × 10⁻⁴ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

NODE=M057R43
NODE=M057R43

NODE=M057R43;LINKAGE=A

NODE=M057R43;LINKAGE=AB

NODE=M057R43;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.4±0.7±0.1		55	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8	90		² ABLIKIM	13H BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<7	90	4.0 ± 3.5	³ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

¹ ABLIKIM 18V reports $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))] = (0.32 \pm 0.06 \pm 0.03) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13H reports < 0.88 × 10⁻⁴ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

³ NAIK 08 reports < 0.67 × 10⁻⁴ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

NODE=M057R44
NODE=M057R44

NODE=M057R44;LINKAGE=A

NODE=M057R44;LINKAGE=AB

NODE=M057R44;LINKAGE=NA

$\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.5±1.8 OUR AVERAGE			[(4.4 ± 1.8) × 10 ⁻⁵ OUR 2023 AVERAGE]		
4.5±1.8±0.1		131	¹ ABLIKIM	20I BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

¹ ABLIKIM 20I reports (4.4 ± 1.7 ± 0.5) × 10⁻⁵ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R99
NODE=M057R99

NEW

NODE=M057R99;LINKAGE=A

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<16	90		¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Sigma}(1385)^-$

¹ ABLIKIM 12I reports < 17 × 10⁻⁵ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.

NODE=M057R68
NODE=M057R68

NODE=M057R68;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Sigma}(1385)^+$
¹ ABLIKIM 12I reports $< 8.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.72 \pm 0.34) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.				

NODE=M057R69
 NODE=M057R69

NODE=M057R69;LINKAGE=AL

 $\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.80±0.32 OUR AVERAGE		[(1.76 ± 0.32) × 10 ⁻⁴ OUR 2023 AVERAGE]		
1.80±0.32±0.04	51	¹ ABLIKIM 15I	BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$
¹ ABLIKIM 15I reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ = (1.68 ± 0.26 ± 0.15) × 10 ⁻⁵ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R81
 NODE=M057R81

NEW

NODE=M057R81;LINKAGE=A

 $\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.22 OUR AVERAGE		[(1.83 ± 0.22) × 10 ⁻⁴ OUR 2023 AVERAGE]			
1.86±0.22±0.05		804	¹ ABLIKIM 220	BES3	$\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.1	90	3	² NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$
¹ ABLIKIM 220 reports $(1.83 \pm 0.15 \pm 0.16) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

NODE=M057R45
 NODE=M057R45

NEW

NODE=M057R45;LINKAGE=A

NODE=M057R45;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.46±0.12 OUR AVERAGE		[(1.44 ± 0.12) × 10 ⁻⁴ OUR 2023 AVERAGE]			
1.47±0.12±0.04		1691	¹ ABLIKIM 220	BES3	$\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$
1.45±0.32±0.04		29 ± 5	² NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^- \bar{\Xi}^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		³ ABLIKIM 06D	BES2	$\psi(2S) \rightarrow \chi_{c2} \gamma$
¹ ABLIKIM 220 reports $(1.44 \pm 0.06 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.33 \pm 0.14 \pm 0.61) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
³ Using $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (9.3 \pm 0.6)\%$.					

NODE=M057R17
 NODE=M057R17

NEW

NODE=M057R17;LINKAGE=A

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.52±0.24±0.18	1038	ABLIKIM 23T	BES3	$\chi_{cJ} \rightarrow \Omega^- \bar{\Omega}^+$

NODE=M057P03
 NODE=M057P03

 $\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE 81	SPEC	190 GeV $\pi^- \text{Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
 NODE=M057R13

$\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-3}$	90	¹ ABLIKIM	15N BES3	$\psi(2S) e^+ e^- \rightarrow \gamma \pi^0 \eta_c$
¹ Using $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.				

 Γ_{92}/Γ

NODE=M057R77
 NODE=M057R77

NODE=M057R77;LINKAGE=A

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.54 \times 10^{-2}$	90	^{1,2} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<1.2 \times 10^{-2}$	90	^{1,3} ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$
¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.				
² From the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.				
³ From the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.				

 Γ_{93}/Γ

NODE=M057R76
 NODE=M057R76

OCCUR=2

NODE=M057R76;LINKAGE=A

NODE=M057R76;LINKAGE=B

NODE=M057R76;LINKAGE=C

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma(K^0 K^+ \pi^- + \text{c.c.})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<16.4	90	¹ LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$
¹ We divided the reported limit by 2 to take into account the $K_L^0 K^+ \pi^-$ mode.				

 Γ_{93}/Γ_{42}

NODE=M057R64
 NODE=M057R64

NODE=M057R64;LINKAGE=LE

NODE=M057310

RADIATIVE DECAYS

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<19	90	13 ± 11	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<40	90	17.2 ± 6.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$
¹ ABLIKIM 11E reports $< 20.8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					
² BENNETT 08A reports $< 50 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

 Γ_{95}/Γ

NODE=M057R40
 NODE=M057R40

NODE=M057R40;LINKAGE=AB

NODE=M057R40;LINKAGE=BE

 $\Gamma(\gamma \omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<6	90	1 ± 6	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \omega$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6	90	0.0 ± 1.8	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \omega$
¹ ABLIKIM 11E reports $< 6.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					
² BENNETT 08A reports $< 7.0 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

 Γ_{96}/Γ

NODE=M057R41
 NODE=M057R41

NODE=M057R41;LINKAGE=AB

NODE=M057R41;LINKAGE=BE

 $\Gamma(\gamma \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 8 (CL = 90%)	$[< 7 \times 10^{-6} \text{ (CL = 90\%)} \text{ OUR 2023 BEST LIMIT}]$				
< 8	90	5 ± 5	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<11	90	1.3 ± 2.5	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \phi$
¹ ABLIKIM 11E reports $< 8.1 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					
² BENNETT 08A reports $< 13 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \gamma \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.36 \times 10^{-2}$.					

 Γ_{97}/Γ

NODE=M057R42
 NODE=M057R42

NODE=M057R42;LINKAGE=AB

NODE=M057R42;LINKAGE=BE

$\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.41 \pm 0.15 \pm 0.06$	1.3k	^{1,2} ABLIKIM	17I	BES3	$\psi(2S) \rightarrow \gamma e^+ e^- J/\psi$

¹ ABLIKIM 17I reports $(2.48 \pm 0.08 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow e^+ e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.11 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.36 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent from other measurements reported by ABLIKIM 17I

NODE=M057R82
NODE=M057R82

NODE=M057R82;LINKAGE=B

NODE=M057R82;LINKAGE=C

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ Γ_{99}/Γ_{94}

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

$11.3 \pm 0.4 \pm 0.5$	1.3k	¹ ABLIKIM	17I	BES3	$\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

¹ Uses $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) \times B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (199.6 \pm 0.8 \pm 7.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M057R83
NODE=M057R83

NODE=M057R83;LINKAGE=A

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$ Γ_{100}/Γ_{99}

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

$9.40 \pm 0.79 \pm 1.15$	219	ABLIKIM	19Z	BES3	$\psi(2S) \rightarrow \gamma \chi_c \rightarrow \gamma(\mu^+\mu^- J/\psi)$

NODE=M057R96
NODE=M057R96

 $\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{98}/Γ_{94}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

1.50 ± 0.08 OUR FIT	Error includes scale factor of 1.5.	$[(1.50 \pm 0.05) \times 10^{-3}$	OUR 2023 FIT]

0.99 ± 0.18	¹ AMBROGIANI 00B	E835	$\bar{p}p \rightarrow \chi_{c2} \rightarrow \gamma\gamma, \gamma J/\psi$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

NODE=M057R23
NODE=M057R23

NEW

NODE=M057R;LINKAGE=7A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$ $\Gamma_{98}/\Gamma \times \Gamma_{56}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

2.12 ± 0.15 OUR FIT	Error includes scale factor of 1.2.	$[(2.09 \pm 0.13) \times 10^{-8}$	OUR 2023 FIT]

1.7 ± 0.4 OUR AVERAGE

1.60 ± 0.42	ARMSTRONG	93	E760	$\bar{p}p \rightarrow \gamma\gamma X$
9.9 ± 4.5	BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma X$

NODE=M057R24
NODE=M057R24

NEW

 $\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{14}/\Gamma \times \Gamma_{181}^{(2S)}/\Gamma_{12}^{(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT

2.24 ± 0.30 OUR FIT	Error includes scale factor of 1.2.	$[(2.31 \pm 0.26) \times 10^{-3}$	OUR 2023 FIT]

2.5 ± 0.9 OUR AVERAGE Error includes scale factor of 2.3.

$1.90 \pm 0.14 \pm 0.44$	BAI	99B	BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
3.8 ± 0.67	¹ TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ The reported value is derived using $B(\psi(2S) \rightarrow \pi^+ \pi^- J/\psi) \times B(J/\psi \rightarrow \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B18
NODE=M057B18

NEW

NODE=M057B18;LINKAGE=TA

$$\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma \times \Gamma_{181}^{(2S)}/\Gamma_{12}^{(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

2.1 ± 0.9 OUR FIT	Error includes scale factor of 2.3.	$[(2.1 \pm 0.4) \times 10^{-4}$	OUR 2023 FIT]

$3.11 \pm 0.36 \pm 0.48$	ABLIKIM	04H	BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B19
NODE=M057B19

NEW

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{56}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) DOCUMENT ID TECN COMMENT
1.96±0.10 OUR FIT Error includes scale factor of 1.1. [(2.01 ± 0.09) × 10⁻⁵ OUR 2023 FIT]

NODE=M057B1
 NODE=M057B1

NEW

1.4 ± 1.1 ¹ BAI 98I BES $\psi(2S) \rightarrow \gamma\chi_{c2} \rightarrow \gamma\bar{p}p$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B;LINKAGE=J8

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{56}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
6.79±0.34 OUR FIT Error includes scale factor of 1.1. [(6.98 ± 0.32) × 10⁻⁶ OUR 2023 FIT]

NODE=M057B6
 NODE=M057B6

NEW

7.1 ± 0.5 OUR AVERAGE Error includes scale factor of 1.2.

7.3 ± 0.4 ± 0.3 405 ABLIKIM 13V BES3 $\psi(2S) \rightarrow \gamma p\bar{p}$

7.2 ± 0.7 ± 0.4 121 ± 12 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma p\bar{p}$

4.4 ^{+1.6}_{-1.4} ± 0.6 14.3 ^{+5.2}_{-4.7} BAI 04F BES $\psi(2S) \rightarrow \gamma\chi_{c2}(1P) \rightarrow \gamma\bar{p}p$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow p\bar{p}) = (7.7 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B6;LINKAGE=NA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{69}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
17.4±1.4 OUR FIT
17.3±1.5 OUR AVERAGE

NODE=M057B10
 NODE=M057B10

18.2±0.8±1.7 670 ABLIKIM 21L BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+$

15.9±2.1±1.0 71 ¹ NAIK 08 CLEO $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

18.2±1.4±0.9 207 ^{2,3} ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (17.0 \pm 2.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B10;LINKAGE=NA

² Superseded by ABLIKIM 21L

³ Calculated by us. ABLIKIM 13H reports $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) = (20.8 \pm 1.6 \pm 2.3) \times 10^{-5}$ from a measurement of $B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma\chi_{c2})$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = (8.74 \pm 0.35)\%$.

NODE=M057B10;LINKAGE=A
 NODE=M057B10;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{69}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
5.0±0.4 OUR FIT

NODE=M057B11
 NODE=M057B11

7.1^{+3.1}_{-2.9}±1.3 8.3^{+3.7}_{-3.4} ¹ BAI 03E BES $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c2} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c2}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.59}_{-0.55} ± 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^- p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

NODE=M057B11;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{74}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
1.00±0.20±0.14 32 ABLIKIM 22A0 BES3 $\psi(2S) \rightarrow \gamma p\pi^-\bar{p}\pi^+\gamma\gamma$

NODE=M057P02
 NODE=M057P02

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{25}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
2.12±0.08 OUR FIT
 [(2.12 ± 0.08) × 10⁻⁴ OUR 2023 FIT]

NODE=M057B02
 NODE=M057B02

NEW

2.17±0.09 OUR AVERAGE

2.19±0.05±0.15 4.5k ¹ ABLIKIM 10A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

2.23±0.06±0.10 2.5k ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma\pi^+\pi^-$

1.90±0.08±0.20 0.8k ³ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma\pi^0\pi^0$

OCCUR=2

- ¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \pi^0 \pi^0) = (0.88 \pm 0.02 \pm 0.06 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi\pi$.
- ² Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^+ \pi^-) = (1.59 \pm 0.04 \pm 0.07 \pm 0.10) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi\pi$.
- ³ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow \pi^0 \pi^0) = (0.68 \pm 0.03 \pm 0.07 \pm 0.04) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$. We have multiplied the $\pi^0 \pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M057B02;LINKAGE=AB

NODE=M057B02;LINKAGE=AS

NODE=M057B02;LINKAGE=AN

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \pi\pi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{25}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.611±0.024 OUR FIT[(0.612 ± 0.023) × 10⁻³ OUR 2023 FIT]**0.54 ±0.06 OUR AVERAGE**0.66 ±0.18 ±0.37 21 ± 6 ¹ BAI 03C BES $\psi(2S) \rightarrow \gamma \pi^0 \pi^0$ 0.54 ±0.05 ±0.04 185 ± 16 ² BAI 98I BES $\psi(2S) \rightarrow \gamma \pi^+ \pi^-$ ¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi\pi$.

² Calculated by us. The value for $B(\chi_{c2} \rightarrow \pi^+ \pi^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D]. We have multiplied $\pi^+ \pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M057B9

NODE=M057B9

NEW

NODE=M057B;LINKAGE=BM

NODE=M057B;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \eta\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{31}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-4}) CL% EVTS DOCUMENT ID TECN COMMENT

0.52±0.04 OUR FIT**0.52±0.04 OUR AVERAGE**0.54±0.03±0.04 386 ¹ ABLIKIM 10A BES3 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$ 0.47±0.05±0.05 156 ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \eta \eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.44 90 ² ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c2}$ < 3 90 BAI 03C BES $\psi(2S) \rightarrow \gamma \eta \eta \rightarrow 5\gamma$ 0.62±0.31±0.19 LEE 85 CBAL $\psi(2S) \rightarrow \text{photons}$

¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c2} \rightarrow \eta\eta) = (0.65 \pm 0.04 \pm 0.05 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.3 \pm 0.4)\%$.

² Superseded by ASNER 09.

NODE=M057B04

NODE=M057B04

NODE=M057B04;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}}{\Gamma_{32}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

9.5±1.4 OUR FIT Error includes scale factor of 2.4. [(9.6 ± 0.6) × 10⁻⁵ OUR 2023 FIT]

10.5±0.3±0.6 1.6k ¹ ASNER 09 CLEO $\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K^+ K^-) = (1.13 \pm 0.03 \pm 0.06 \pm 0.07) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B03

NODE=M057B03

NEW

NODE=M057B03;LINKAGE=AS

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{32}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-3}) EVTS DOCUMENT ID TECN COMMENT

0.27 ±0.04 OUR FIT Error includes scale factor of 2.4. [(0.276 ± 0.017) × 10⁻³ OUR 2023 FIT]

0.190±0.034±0.019 115 ± 13 ¹ BAI 98I BES $\psi(2S) \rightarrow \gamma K^+ K^-$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow K^+ K^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B8

NODE=M057B8

NEW

NODE=M057B;LINKAGE=BI

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{33} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
5.0 ± 0.4 OUR FIT				
5.0 ± 0.4 OUR AVERAGE				
4.9 ± 0.3 ± 0.3	373 ± 20	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
5.72 ± 0.76 ± 0.63	65	ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Calculated by us. ASNER 09 reports $B(\chi_{c2} \rightarrow K_S^0 K_S^0) = (0.53 \pm 0.03 \pm 0.03 \pm 0.03) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

NODE=M057B12
NODE=M057B12

NODE=M057B12;LINKAGE=AS

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{33} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
14.3 ± 1.1 OUR FIT			
[(14.4 ± 1.1) × 10 ⁻⁵ OUR 2023 FIT]			
14.7 ± 4.1 ± 3.3	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow K_S^0 K_S^0)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B13
NODE=M057B13

NEW

NODE=M057B13;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{42} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.22 ± 0.17 OUR FIT				
[(1.22 ± 0.17) × 10 ⁻⁴ OUR 2023 FIT]				
1.15 ± 0.18 OUR AVERAGE				

1.21 ± 0.19 ± 0.09	37	¹ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
0.97 ± 0.32 ± 0.13	28	² ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

¹ Calculated by us. ATHAR 07 reports $B(\chi_{c2} \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (1.3 \pm 0.2 \pm 0.1 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.33 \pm 0.14 \pm 0.61)\%$.

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c2} \rightarrow K_S^0 K^\pm \pi^\mp) = (0.6 \pm 0.2 \pm 0.1) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.1 \pm 0.6)\%$. We have multiplied by 2 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$ from $K_S^0 K^\pm \pi^\mp$.

NODE=M057B05
NODE=M057B05

NEW

NODE=M057B05;LINKAGE=AT

NODE=M057B05;LINKAGE=AB

$$\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_1 / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.7 ± 0.4 OUR FIT			
Error includes scale factor of 1.4. [(2.79 ± 0.26) × 10 ⁻³ OUR 2023 FIT]			
3.1 ± 1.0 OUR AVERAGE			

2.3 ± 0.1 ± 0.5	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c2}$
4.3 ± 0.6	² TANENBAUM	78 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Calculated by us. The value for $B(\chi_{c2} \rightarrow 2\pi^+ 2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow 2\pi^+ \pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times B(J/\psi(1S) \ell^+ \ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

NODE=M057B5
NODE=M057B5

NEW

NODE=M057B;LINKAGE=K1

NODE=M057B;LINKAGE=K2

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{51} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.56 ± 0.21 OUR FIT				
Error includes scale factor of 1.1. [(1.57 ± 0.19) × 10 ⁻⁴ OUR 2023 FIT]				
1.76 ± 0.16 ± 0.24	160	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B14
NODE=M057B14

NEW

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{51} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
4.5 ± 0.6 OUR FIT Error includes scale factor of 1.1. $[(4.5 \pm 0.5) \times 10^{-4}$ OUR 2023 FIT]

NODE=M057B15
 NODE=M057B15
 NEW

3.6 ± 0.6 ± 0.6 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{20} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT
1.15 ± 0.07 OUR FIT Error includes scale factor of 1.8. $[(1.01 \pm 0.08) \times 10^{-4}$ OUR 2023 FIT]

NODE=M057B16
 NODE=M057B16
 NEW

0.98 ± 0.13 OUR AVERAGE Error includes scale factor of 1.3.
 0.94 ± 0.03 ± 0.10 849 ¹ ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons
 1.38 ± 0.24 ± 0.23 41 ² ABLIKIM 06T BES2 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.74 \pm 0.35)\%$.
² Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (8.1 \pm 0.4)\%$.

NODE=M057B16;LINKAGE=AL

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)}{\Gamma_{20} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT
3.31 ± 0.21 OUR FIT Error includes scale factor of 1.7. $[(2.92 \pm 0.24) \times 10^{-4}$ OUR 2023 FIT]

NODE=M057B17
 NODE=M057B17
 NEW

4.8 ± 1.3 ± 1.3 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
¹ Calculated by us. The value of $B(\chi_{c2} \rightarrow \phi \phi)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (7.8 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{81} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT
7.85 ± 0.77 ± 0.44 129 ¹ ABLIKIM 19BB BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

NODE=M057B07
 NODE=M057B07

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c2} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (8.25 \pm 0.83 \pm 0.49) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.52 \pm 0.20)\%$ and other branching fractions from PDG 18.

NODE=M057B07;LINKAGE=A

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{82} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT
0.87 ± 0.06 ± 0.04 271 ¹ ABLIKIM 20AE BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

NODE=M057P00
 NODE=M057P00

¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_{c2} \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (0.91 \pm 0.06 \pm 0.05) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (9.52 \pm 0.20)\%$ and other branching fractions from PDG 20.

NODE=M057P00;LINKAGE=A

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}}{\Gamma_{94} / \Gamma \times \Gamma_{181}^{\psi(2S)} / \Gamma_{12}^{\psi(2S)}}$$

VALUE (units 10^{-2}) EVTS DOCUMENT ID TECN COMMENT
1.82 ± 0.07 OUR FIT Error includes scale factor of 1.9. $[(1.81 \pm 0.04) \times 10^{-2}$ OUR 2023 FIT]

NODE=M057B2
 NODE=M057B2
 NEW

1.69 ± 0.16 OUR AVERAGE Error includes scale factor of 3.4. See the ideogram below.
 1.996 ± 0.008 ± 0.070 81k ¹ ABLIKIM 17N BES3 $\psi(2S) \rightarrow \gamma \gamma J/\psi$
 1.793 ± 0.008 ± 0.163 1.0M ABLIKIM 17U BES3 $e^+ e^- \rightarrow \gamma X$
 1.62 ± 0.04 ± 0.12 5.8k BAI 04I BES2 $\psi(2S) \rightarrow J/\psi \gamma \gamma$
 0.99 ± 0.10 ± 0.08 GAISER 86 CBAL $\psi(2S) \rightarrow \gamma X$
 1.47 ± 0.17 ² OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma \chi_{c2}$
 1.8 ± 0.5 ³ BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma \chi_{c2}$
 1.2 ± 0.2 ³ BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma \chi_{c2}$
 2.2 ± 1.2 ⁴ BIDDICK 77 CNTR $e^+ e^- \rightarrow \gamma X$
 1.2 ± 0.7 ² WHITAKER 76 MRK1 $e^+ e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.874 \pm 0.007 \pm 0.102$	76k	⁵ ABLIKIM	120	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2}$
$1.95 \pm 0.02 \pm 0.07$	12.4k	⁶ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
$1.85 \pm 0.04 \pm 0.07$	1.9k	⁷ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

⁴ Assumes isotropic gamma distribution.

⁵ Superseded by ABLIKIM 17N.

⁶ Not independent from other measurements of MENDEZ 08.

⁷ Not independent from other values reported by ADAM 05A.

NODE=M057B2;LINKAGE=A

NODE=M057B;LINKAGE=3Q

NODE=M057B;LINKAGE=2Q

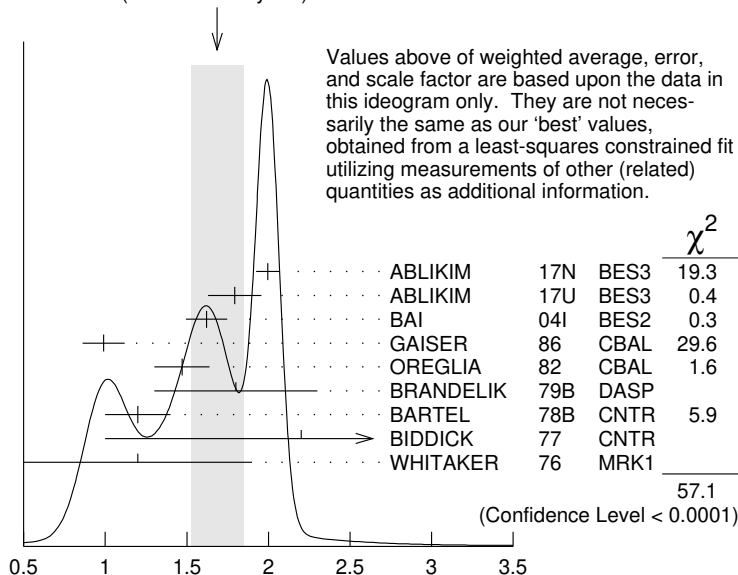
NODE=M057B;LINKAGE=EA

NODE=M057B2;LINKAGE=BA

NODE=M057B2;LINKAGE=ME

NODE=M057B;LINKAGE=AD

WEIGHTED AVERAGE
 1.69 ± 0.16 (Error scaled by 3.4)



$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$ (units 10^{-2})

$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$
 $\Gamma_{94}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.26 ± 0.19 OUR FIT	Error includes scale factor of 1.8.			[(5.22 ± 0.11) × 10 ⁻² OUR 2023 FIT]

5.53 ± 0.17 OUR AVERAGE

$5.56 \pm 0.05 \pm 0.16$	12.4k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
6.0 ± 2.8	1.3k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
3.9 ± 1.2		² HIMEL	80	MRK2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.52 \pm 0.13 \pm 0.13$	1.9k	³ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma \chi_{c2}) \times B(\chi_{c2} \rightarrow \gamma J/\psi(1S))$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

NODE=M057B;LINKAGE=AB

NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$\Gamma(\chi_{c2}(1P) \rightarrow \gamma \gamma)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$
 $\Gamma_{98}/\Gamma \times \Gamma_{181}^{\psi(2S)}/\Gamma_{12}^{\psi(2S)}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.74 ± 0.10 OUR FIT	Error includes scale factor of 1.3.			[(2.71 ± 0.08) × 10 ⁻⁵ OUR 2023 FIT]

2.82 ± 0.10 OUR AVERAGE

$2.83 \pm 0.08 \pm 0.06$	5k	¹ ABLIKIM	17AE	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
$2.68 \pm 0.28 \pm 0.15$	0.3k	ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
$7.0 \pm 2.1 \pm 2.0$		LEE	85	CBAL	$\psi(2S) \rightarrow \gamma \chi_{c2}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.81 \pm 0.17 \pm 0.15$	1.1k	² ABLIKIM	12A	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$

NODE=M057B4

NODE=M057B4

NEW

- ¹ ABLIKIM 17AE measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \Gamma_{\gamma\gamma}^{\lambda=0} / \Gamma_{\gamma\gamma}^{\lambda=2} = 0.000 \pm 0.006 \pm 0.012$.
- ² ABLIKIM 12A measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \Gamma_{\gamma\gamma}^{\lambda=0} / \Gamma_{\gamma\gamma}^{\lambda=2} = 0.00 \pm 0.02 \pm 0.02$. Superseded by ABLIKIM 17AE.

NODE=M057B4;LINKAGE=A

NODE=M057B4;LINKAGE=AB

$\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma) / \Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)$		$\Gamma_{98} / \Gamma_{98}^{\chi_{c0}(1P)}$		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.292±0.028 OUR AVERAGE				
0.295±0.014±0.028	8k	¹ ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$
0.278±0.050±0.036	0.5k	¹ ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.271±0.029±0.030	1.9k	^{1,2} ABLIKIM	12A BES3	$\psi(2S) \rightarrow \gamma\chi_{cJ} \rightarrow 3\gamma$
¹ Not independent from the values of $\Gamma(\chi_{c0}, \chi_{c2})$ and $B(\psi(2S) \rightarrow \chi_{c0}, \chi_{c2})$.				
² Superseded by ABLIKIM 17AE.				

NODE=M057B06
NODE=M057B06NODE=M057B06;LINKAGE=AB
NODE=M057B06;LINKAGE=A

MULTIPOLE AMPLITUDES IN $\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)$ RADIATIVE DECAY

NODE=M057240

$a_2 = M2 / \sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11.0± 1.0 OUR AVERAGE				
-12.0± 1.3±0.4	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
- 9.3± 1.6±0.3	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
- 9.3 ⁺ ₋ 3.9 ⁺ ₋ 4.1±0.6	5.9k	³ AMBROGIANI	02 E835	$\rho\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-14 ± 6	1.9k	³ ARMSTRONG	93E E760	$\rho\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
-33.3 ⁺ ₋ 11.6 ₋ 29.2	441	³ OREGLIA	82 CBAL	$\psi(2S) \rightarrow \chi_{c1}\gamma \rightarrow J/\psi\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
- 7.9± 1.9±0.3	19.8k	⁴ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
¹ Correlated with a_3 , b_2 , and b_3 with correlation coefficients $\rho_{a_2 a_3} = 0.733$, $\rho_{a_2 b_2} = -0.605$, and $\rho_{a_2 b_3} = -0.095$.				
² From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ amplitudes $a_3=b_3=0$.				
³ Assuming $a_3=0$.				
⁴ From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .				

NODE=M057A1
NODE=M057A1

OCCUR=2

NODE=M057A1;LINKAGE=B

NODE=M057A1;LINKAGE=AR
NODE=M057A1;LINKAGE=A
NODE=M057A1;LINKAGE=AT

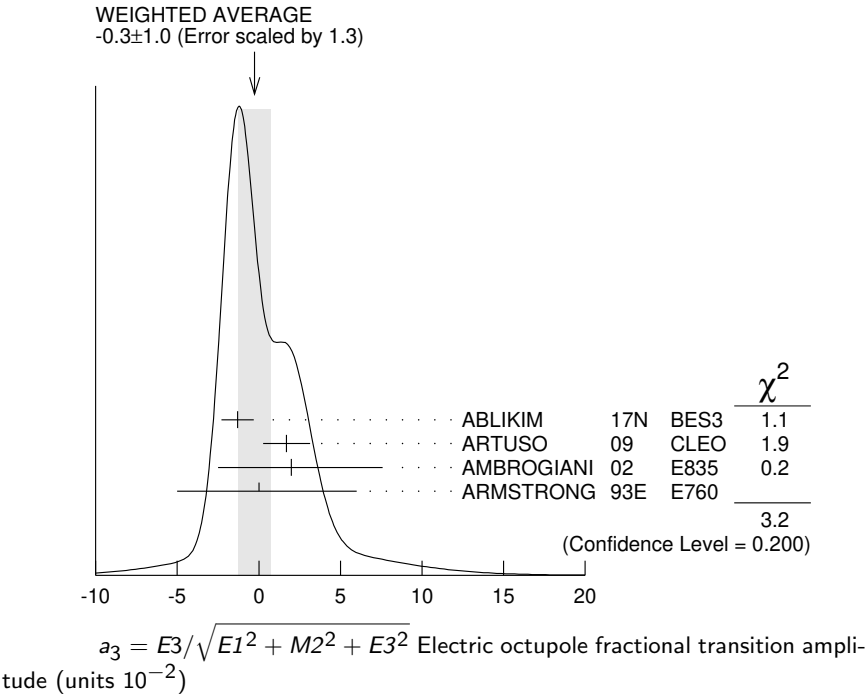
$a_3 = E3 / \sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-0.3±1.0 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.				
-1.3±0.9±0.4	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
1.7±1.4±0.3	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.0 ⁺ ₋ 5.5 ⁺ ₋ 4.4±0.9	5908	AMBROGIANI	02 E835	$\rho\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0 ⁺ ₋ 6 ₋ 5	1904	ARMSTRONG	93E E760	$\rho\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
¹ Correlated with a_2 , b_2 , and b_3 with correlation coefficients $\rho_{a_2 a_3} = 0.733$, $\rho_{a_3 b_2} = -0.422$, and $\rho_{a_3 b_3} = -0.024$.				
² From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .				

NODE=M057A2
NODE=M057A2

NODE=M057A2;LINKAGE=A

NODE=M057A2;LINKAGE=AR



MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

NODE=M057250

$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M057QB2
NODE=M057QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.9 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
1.7±0.8±0.2	89k	1 ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
4.6±1.0±1.3	13.8k	2 ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
0.2±1.5±0.4	19.8k	3 ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
– 5.1 ^{+5.4} _{–3.6}	721	2 ABLIKIM	04I BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
13.2 ^{+9.8} _{–7.5}	441	4 OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.0±1.3±0.3 19.8k 4 ARTUSO 09 CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

NODE=M057QB2;LINKAGE=A

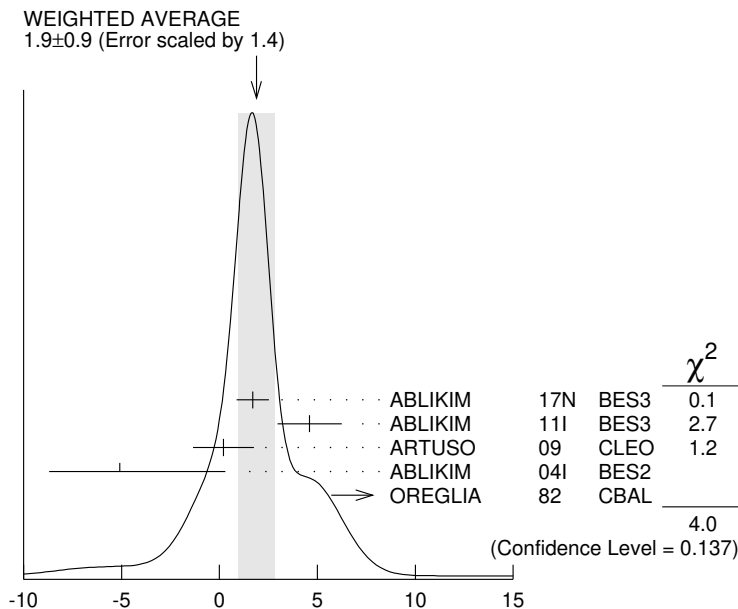
¹ Correlated with a_2 , a_3 , and b_3 with correlation coefficients $\rho_{a_2 b_2} = -0.605$, $\rho_{a_3 b_2} = -0.422$, and $\rho_{b_2 b_3} = 0.384$.

NODE=M057QB2;LINKAGE=AB
NODE=M057QB2;LINKAGE=AT
NODE=M057QB2;LINKAGE=AR

² From a fit with floating $M2$ and $E3$ amplitudes b_2 and b_3 .

³ From a fit with floating $M2$ and $E3$ amplitudes a_2 , b_2 , and a_3 , and b_3 .

⁴ From a fit with floating $M2$ amplitudes a_2 and b_2 , and fixed $E3$ amplitudes $a_3=b_3=0$.



$b_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Magnetic quadrupole fractional transition amplitude (units 10^{-2})

$b_3 = E_3/\sqrt{E_1^2 + M_2^2 + E_3^2}$ Electric octupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-1.0±0.6 OUR AVERAGE				
-1.4±0.7±0.4	89k	¹ ABLIKIM 17N BES3		$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
1.5±0.8±1.8	13.8k	² ABLIKIM 11I BES3		$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
-0.8±1.2±0.2	19.8k	ARTUSO 09 CLEO		$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
-2.7 ^{+4.3} _{-2.9}	721	² ABLIKIM 04I BES2		$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$

¹ Correlated with a_2 , a_3 , and b_2 with correlation coefficients $\rho_{a_2 b_3} = -0.095$, $\rho_{a_3 b_3} = -0.024$, and $\rho_{b_2 b_3} = 0.384$.

² From a fit with floating M_2 and E_3 amplitudes b_2 and b_3 .

NODE=M057QB3
NODE=M057QB3

NODE=M057QB3;LINKAGE=A

NODE=M057QB3;LINKAGE=AB

NODE=M057260

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ and $\chi_{c2} \rightarrow \gamma J/\psi(1S)$

b_2/a_2 Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-11⁺¹⁴₋₁₅	19.8k	¹ ARTUSO 09 CLEO		$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Statistical and systematic errors combined. From a fit with floating M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$. Not independent of values for $a_2(\chi_{c2}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

NODE=M057QAR
NODE=M057QAR

NODE=M057QAR;LINKAGE=AR

$\chi_{c2}(1P)$ REFERENCES

ABLIKIM 23N JHEP 2305 069	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62056
ABLIKIM 23T PR D107 092004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62064
SEINO 23 JHEP 2301 160	Y. Seino <i>et al.</i>	(BELLE Collab.)	REFID=62051
ABLIKIM 22AO PR D106 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61887
ABLIKIM 22O JHEP 2206 074	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61652
ABLIKIM 22Q PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
PDG 22 PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
ABLIKIM 21AV JHEP 2111 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61465
ABLIKIM 21L PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61117
ABLIKIM 20AE PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60733
ABLIKIM 20B PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60212
ABLIKIM 20I PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60303
PDG 20 PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM 19AA PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59844
ABLIKIM 19AU PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM 19BB PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60026
ABLIKIM 19J PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59606
ABLIKIM 19Z PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59837
ABLIKIM 18V PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58990
PDG 18 PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
AAIJ 17BB EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
AAIJ 17BI PRL 119 221801	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58278
ABLIKIM 17AE PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58310

NODE=M057

ABLIKIM	17AG	PR D96 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58316
ABLIKIM	17AI	PR D96 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58321
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABLIKIM	15N	PR D91 112018	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56779
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55901
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54877
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54953
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ABLIKIM	12A	PR D85 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54266
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54736
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54737
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
LIU	12B	PRL 108 232001	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=54303
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53647
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16717
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=16719
ABLIKIM	11I	PR D84 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53930
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53940
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
ABLIKIM	10A	PR D81 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53347
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)	REFID=53360
UEHARA	10A	PR D82 114031	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53641
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
ASNER	09	PR D79 072007	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52721
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52761
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)	REFID=52575
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)	REFID=52583
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52588
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)	REFID=52301
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
ADAMS	07	PR D75 071101	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=51651
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51618
CHEN	07B	PL B651 15	W.T. Chen <i>et al.</i>	(BELLE Collab.)	REFID=51710
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51049
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51453
DOBBS	06	PR D73 071101	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=51062
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50756
ABLIKIM	05N	PL B630 7	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50847
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50769
NAKAZAWA	05	PL B615 39	H. Nakazawa <i>et al.</i>	(BELLE Collab.)	REFID=50807
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50188
ABLIKIM	04I	PR D70 092004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50189
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49752
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49416
ABE	02T	PL B540 33	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=48813
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48552
EISENSTEIN	01	PRL 87 061801	B.I. Eisenstein <i>et al.</i>	(CLEO Collab.)	REFID=48344
AMBROGIANI	00B	PR D62 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47940
ACCIARRI	99E	PL B453 73	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=46943
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47385
ACKER...K...	98	PL B439 197	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46324
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46338
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46343
DOMINICK	94	PR D50 4265	J. Dominick <i>et al.</i>	(CLEO Collab.)	REFID=44077
ARMSTRONG	93	PRL 70 2988	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43306
ARMSTRONG	93E	PR D48 3037	T.A. Armstrong <i>et al.</i>	(FNAL-E760 Collab.)	REFID=48616
BAUER	93	PL B302 345	D.A. Bauer <i>et al.</i>	(TPC Collab.)	REFID=43315
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41865
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=41907
BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)	REFID=40018
BAGLIN	86B	PL B172 455	C. Baglin (LAPP, CERN, GENO, LYON, OSLO+)		REFID=22145
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22120
Also		Private Comm.	M.J. Oreglia	(EFI)	REFID=22143
BARATE	81	PR D24 2994	R. Barate <i>et al.</i>	(SACL, LOIC, SHMP, CERN+)	REFID=22164
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
Also		Private Comm.	G. Trilling	(LBL, UCB)	REFID=22113
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151

$$\eta_c(2S)$$

$$J^{PC} = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

NEW

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3637.7 ± 0.9 OUR AVERAGE		Error includes scale factor of 1.2. [3637.7 ± 1.1 MeV OUR 2023 AVERAGE Scale factor = 1.2]		
3637.90 ± 0.54 ± 1.40	3.7k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
3643.4 ± 2.3 ± 4.4	569	ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
3635.1 ± 3.7 ± 2.9	106	XU	18 BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
3633.6 ± 1.7 ± 0.6	106	¹ AAIJ	17AD LHCB	$pp \rightarrow B^+ X \rightarrow p \bar{p} K^+ X$
3636.4 ± 4.1 ± 0.7	365	² AAIJ	17BB LHCB	$pp \rightarrow b \bar{b} X \rightarrow 2(K^+ K^-) X$
3637.0 ± 5.7 ± 3.4	178	^{3,4} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^0$
3635.1 ± 5.8 ± 2.1	47	^{3,5} LEES	14E BABR	$\gamma \gamma \rightarrow K^+ K^- \eta$
3646.9 ± 1.6 ± 3.6	57	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6 ± 2.9 ± 1.6	127	⁶ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
3638.5 ± 1.5 ± 0.8	624	³ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 ± 3.2 ± 2.5	1201	³ DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
3636.1 ^{+3.9} _{-4.2} ^{+0.7} _{-2.0}	128	⁷ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
3626 ± 5 ± 6	311	⁸ ABE	07 BELL	$e^+ e^- \rightarrow J/\psi (c \bar{c})$
3645.0 ± 5.5 ^{+4.9} _{-7.8}	121	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c \bar{c}$
3642.9 ± 3.1 ± 1.5	61	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3639 ± 7	98	⁹ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c \bar{c}}$
3630.8 ± 3.4 ± 1.0	112	¹⁰ AUBERT	04D BABR	$\gamma \gamma \rightarrow \eta_c(2S) \rightarrow K \bar{K} \pi$
3654 ± 6 ± 8	39	¹¹ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
3594 ± 5		¹² EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ AAIJ 17AD report $m_{\psi(2S)} - m_{\eta_c(2S)} = 52.5 \pm 1.7 \pm 0.6$ MeV. We use the current value $m_{\psi(2S)} = 3686.097 \pm 0.025$ MeV to obtain the quoted mass.

² From a fit of the $\phi \phi$ invariant mass with the width of $\eta_c(2S)$ fixed to the PDG 16 value.

³ Ignoring possible interference with continuum.

⁴ With a width fixed to 11.3 MeV.

⁵ With a width fixed to 11.3 MeV. Using both $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow \pi^+ \pi^- \pi^0$ decays.

⁶ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

⁷ Accounts for interference with non-resonant continuum.

⁸ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE, K 02 and ABE 04G.

⁹ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁰ Superseded by DEL-AMO-SANCHEZ 11M.

¹¹ Superseded by VINOKUROVA 11.

¹² Assuming mass of $\psi(2S) = 3686$ MeV.

OCCUR=2

OCCUR=2

NODE=M059M;LINKAGE=B

NODE=M059M;LINKAGE=C
 NODE=M059M;LINKAGE=DE
 NODE=M059M;LINKAGE=LE
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 NODE=M059M;LINKAGE=EB
 NODE=M059M;LINKAGE=AU
 NODE=M059M;LINKAGE=AR
 NODE=M059M;LINKAGE=CH
 NODE=M059M;LINKAGE=A

$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
11.8 ± 1.6 OUR AVERAGE		[13.9 ± 2.6 MeV OUR 2023 AVERAGE]		
10.77 ± 1.62 ± 1.08	3.7k	AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
19.8 ± 3.9 ± 3.1	569	ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+ \pi^-)$
9.9 ± 4.8 ± 2.9	57	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
16.9 ± 6.4 ± 4.8	127	¹ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$
13.4 ± 4.6 ± 3.2	624	² DEL-AMO-SA..11M	BABR	$\gamma \gamma \rightarrow K_S^0 K^\pm \pi^\mp$
6.6 ^{+8.4} _{-5.1} ^{+2.6} _{-0.9}	128	³ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm (K_S^0 K^\pm \pi^\mp)$
6.3 ± 12.4 ± 4.0	61	ASNER	04 CLEO	$\gamma \gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M059W

NODE=M059W

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 23	90	98	⁴ AUBERT	06E	BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
22 ± 14		121	AUBERT	05C	BABR	$e^+ e^- \rightarrow J/\psi c\bar{c}$
17.0 ± 8.3 ± 2.5		112	⁵ AUBERT	04D	BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
<55	90	39	⁶ CHOI	02	BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		⁷ EDWARDS	82C	CBAL	$e^+ e^- \rightarrow \gamma X$

¹ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

² Ignoring possible interference with continuum.

³ Accounts for interference with non-resonant continuum.

⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

⁵ Superseded by DEL-AMO-SANCHEZ 11M.

⁶ For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.

⁷ For a mass value of 3594 ± 5 MeV

NODE=M059W;LINKAGE=AB
 NODE=M059W;LINKAGE=DE
 NODE=M059W;LINKAGE=VA
 NODE=M059W;LINKAGE=AU
 NODE=M059W;LINKAGE=AR
 NODE=M059W;LINKAGE=W2
 NODE=M059W;LINKAGE=W

$\eta_c(2S)$ DECAY MODES

NODE=M059215;NODE=M059

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	seen	
Γ_2 $K\bar{K}\pi$	(1.9±1.2) %	
Γ_3 $K\bar{K}\eta$	(5 ± 4) × 10 ⁻³	
Γ_4 $2\pi^+ 2\pi^-$	< 2.1 %	90%
Γ_5 $\rho^0 \rho^0$	< 1.9 × 10 ⁻³	90%
Γ_6 $3\pi^+ 3\pi^-$	(1.3±0.9) %	
Γ_7 $K^+ K^- \pi^+ \pi^-$	< 1.4 %	90%
Γ_8 $K^{*0} \bar{K}^{*0}$	< 2.9 × 10 ⁻³	90%
Γ_9 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4±1.0) %	
Γ_{10} $K^+ K^- 2\pi^+ 2\pi^-$	< 1.4 %	90%
Γ_{11} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	(1.0±0.8) %	
Γ_{12} $2K^+ 2K^-$	< 1.3 × 10 ⁻³	90%
Γ_{13} $\phi\phi$	< 1.1 × 10 ⁻³	90%
Γ_{14} $p\bar{p}$	< 2.0 × 10 ⁻³	90%
Γ_{15} $p\bar{p}\pi^+ \pi^-$	seen	
Γ_{16} $\gamma\gamma$	(1.8±1.2) × 10 ⁻⁴	
Γ_{17} $\gamma J/\psi(1S)$	< 1.4 %	90%
Γ_{18} $\pi^+ \pi^- \eta$	(4.3±3.2) × 10 ⁻³	
Γ_{19} $\pi^+ \pi^- \eta'$	(2.6±1.9) × 10 ⁻³	
Γ_{20} $K_2^*(1430) \bar{K} + \text{c.c.}$	seen	
Γ_{21} $K_0^*(1950) \bar{K} + \text{c.c.}$	seen	
Γ_{22} $a_0(1710)\pi$	seen	
Γ_{23} $a_0(1450)\pi$	seen	
Γ_{24} $a_2(1700)\pi$	seen	
Γ_{25} $K_0^*(2600) \bar{K} + \text{c.c.}$	seen	
Γ_{26} $\pi^+ \pi^- \eta_c(1S)$	< 25 %	90%

DESIG=1;OUR EST;→ UNCHECKED ←
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 DESIG=20
 DESIG=5
 DESIG=16
 DESIG=8
 DESIG=6
 DESIG=17
 DESIG=9
 DESIG=10
 DESIG=11
 DESIG=7
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 DESIG=21
 DESIG=12
 DESIG=13
 DESIG=24
 DESIG=25
 DESIG=26
 DESIG=27
 DESIG=28
 DESIG=29
 DESIG=15

$\eta_c(2S)$ PARTIAL WIDTHS

NODE=M059216

$\Gamma(\gamma\gamma)$

Γ_{16}

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.44±0.14	106	¹ XU	18	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
1.3 ± 0.6		² ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta'_c \rightarrow K_S^0 K^\pm \pi^\mp$

¹ Assuming that the branching fraction into $\eta' \pi^+ \pi^-$ is the same as for $\eta_c(1S)$.

² They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.

NODE=M059W1;LINKAGE=A
 NODE=M059W1;LINKAGE=AS

$\Gamma(\gamma\gamma) \times \Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$

$\Gamma_{16}\Gamma_{19}/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

$5.6^{+1.2}_{-1.1} \pm 1.1$	106	XU	18	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$

NODE=M059R29
 NODE=M059R29

$\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M059218

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_2 \Gamma_{16} / \Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
41±4±6	624	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

¹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.NODE=M059G04
NODE=M059G04

NODE=M059G04;LINKAGE=DE

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_4 \Gamma_{16} / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.5	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(\pi^+ \pi^-)$

NODE=M059G01
NODE=M059G01

$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_7 \Gamma_{16} / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M059G02
NODE=M059G02

$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_9 \Gamma_{16} / \Gamma$		
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
30±6±5	1201	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.NODE=M059G05
NODE=M059G05

NODE=M059G05;LINKAGE=DE

$\Gamma(2K^+ 2K^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_{12} \Gamma_{16} / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	UEHARA	08	BELL $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow 2(K^+ K^-)$

NODE=M059G03
NODE=M059G03

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_{26} \Gamma_{16} / \Gamma$		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<133	90	LEES	12AE	BABR $e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M059G06
NODE=M059G06 $\eta_c(2S) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma^2(\text{total})$

NODE=M059217

$\Gamma(p\bar{p}) / \Gamma_{\text{total}} \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$		$\Gamma_{14} / \Gamma \times \Gamma_{16} / \Gamma$		
VALUE (units 10 ⁻⁸)	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90	^{1,2,3} AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 8.0	90	^{1,2,4} AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$
<12.0	90	^{2,4} AMBROGIANI 01	E835	$\bar{p}p \rightarrow \gamma\gamma$

¹ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.² For a total width $\Gamma=5$ MeV.³ For the resonance mass region 3589–3599 MeV/ c^2 .⁴ For the resonance mass region 3575–3660 MeV/ c^2 .OCCUR=2
OCCUR=3NODE=M059G1;LINKAGE=A
NODE=M059G1;LINKAGE=B
NODE=M059G1;LINKAGE=C1
NODE=M059G1;LINKAGE=C2 $\eta_c(2S) \text{ BRANCHING RATIOS}$

NODE=M059220

$\Gamma(\text{hadrons}) / \Gamma_{\text{total}}$		Γ_1 / Γ		
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	ABREU	980	DLPH	$e^+ e^- \rightarrow e^+ e^- + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	¹ EDWARDS	82C	CBAL	$e^+ e^- \rightarrow \gamma X$

¹ For a mass value of 3594 ± 5 MeVNODE=M059R1
NODE=M059R1

NODE=M059R;LINKAGE=W

$\Gamma(K\bar{K}\pi) / \Gamma_{\text{total}}$		Γ_2 / Γ		
VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.4±1.1	59 ± 12	¹ AUBERT	08AB	BABR $B \rightarrow \eta_c(2S) K \rightarrow K\bar{K}\pi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	127 ± 18	ABLIKIM	12G	BES3 $\psi(2S) \rightarrow \gamma K\bar{K}\pi$
seen	39 ± 11	² CHOI	02	BELL $B \rightarrow K K_S K^- \pi^+$

¹ Derived from a measurement of $[B(B^+ \rightarrow \eta_c(2S) K^+) \times B(\eta_c(2S) \rightarrow K\bar{K}\pi)] / [B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (9.6_{-1.9}^{+2.0} \pm 2.5)\%$ and using $B(B^+ \rightarrow \eta_c(2S) K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77_{-0.66}^{+0.55}) \times 10^{-5}$.² For a mass value of 3654 ± 6 MeVNODE=M059R3
NODE=M059R3

NODE=M059R3;LINKAGE=AU

NODE=M059R;LINKAGE=W2

$\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$ Γ_3/Γ_2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
27.3±7.0±9.0	225	¹ LEES	14E BABR	$\gamma\gamma \rightarrow K^+ K^- \gamma\gamma$
¹ LEES 14E reports $B(\eta_c(2S) \rightarrow K^+ K^- \eta)/B(\eta_c(2S) \rightarrow K^+ K^- \pi^0) = 0.82 \pm 0.21 \pm 0.27$, which we divide by 3 to account for isospin symmetry.				

NODE=M059R26
 NODE=M059R26

NODE=M059R26;LINKAGE=LE

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R01
 NODE=M059R01

 $\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R15
 NODE=M059R15

 $\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R02
 NODE=M059R02

 $\Gamma(K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R16
 NODE=M059R16

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K\bar{K}\pi)$ Γ_9/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.73±0.17±0.17	1201	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
¹ We have multiplied the value of $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K_S^0 K^\pm \pi^\mp)$ reported in DEL-AMO-SANCHEZ 11M by a factor 1/3 to obtain $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K\bar{K}\pi)$. Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.				

NODE=M059R21
 NODE=M059R21

NODE=M059R21;LINKAGE=DE

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	57±17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$

NODE=M059R22
 NODE=M059R22

 $\Gamma(2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R03
 NODE=M059R03

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R17
 NODE=M059R17

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	106	¹ AAIJ	17AD LHCb	$pp \rightarrow B^+ X \rightarrow p\bar{p} K^+ X$
¹ AAIJ 17AD report a 6.4 standard deviation signal, with $B(B^+ \rightarrow \eta_c(2S) K^+ \rightarrow p\bar{p} K^+)/B(B^+ \rightarrow J/\psi K^+ \rightarrow p\bar{p} K^+) = (1.58 \pm 0.33 \pm 0.09) \times 10^{-2}$.				

NODE=M059R04
 NODE=M059R04

OCCUR=2

NODE=M059R04;LINKAGE=A

 $\Gamma(p\bar{p}\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	110	¹ CHILIKIN	19 BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
¹ CHILIKIN 19 reports signals in $B^+ \rightarrow \eta_c(2S) K^+$ and $B^0 \rightarrow \eta_c(2S) K_S^0$ with 12.3 and 5.9 standard deviations, respectively.				

NODE=M059R30
 NODE=M059R30

NODE=M059R30;LINKAGE=A

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<4 \times 10^{-4}$	90	¹ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma\gamma$
not seen		AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$
<0.01	90	LEE	85	CBAL $\psi' \rightarrow \text{photons}$

¹ WICHT 08 reports $[\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c(2S)K^+)] < 0.18 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c(2S)K^+) = 4.4 \times 10^{-4}$.

NODE=M059R2
NODE=M059R2

NODE=M059R2;LINKAGE=W1

 $\Gamma(\pi^+\pi^-\eta_c(1S))/\Gamma(K\bar{K}\pi)$ Γ_{26}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.33	90	¹ LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$

¹ We divided the reported limit by 3 to take into account isospin relations.

NODE=M059R23
NODE=M059R23

NODE=M059R23;LINKAGE=LE

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

 $\Gamma(\eta_c(2S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<11.8 \times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

¹ CRONIN-HENNESSY 10 reports a limit of $< 5.9 \times 10^{-6}$ for the decay $\eta_c(2S) \rightarrow K^+ K^- \eta$ which we multiply by 2 account for isospin symmetry. It assumes $\Gamma(\eta_c(2S)) = 14$ MeV. It also gives the analytic dependence of limits on width.

NODE=M059R25
NODE=M059R25

NODE=M059R25;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow 2\pi^+2\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<14.6 $\times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R05
NODE=M059R05

NODE=M059R05;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow \rho^0\rho^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_5/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<12.7 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R18
NODE=M059R18

 $\Gamma(\eta_c(2S) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_6/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

$9.2 \pm 1.0 \pm 1.2$	569		ABLIKIM	22Q BES3	$\psi(2S) \rightarrow \gamma 3(\pi^+\pi^-)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.2	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R06
NODE=M059R06

NODE=M059R06;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_7/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<9.6 $\times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R07
NODE=M059R07

NODE=M059R07;LINKAGE=CR

 $\Gamma(\eta_c(2S) \rightarrow K^{*0}\bar{K}^{*0})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_8/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma\psi(2S)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<19.6 $\times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R19
NODE=M059R19

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_9 / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<43.0 \times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059R08
NODE=M059R08

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{10} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

NODE=M059R09
NODE=M059R09

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{11} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$7.03 \pm 2.10 \pm 0.7$	60		ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

NODE=M059R10
NODE=M059R10

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 15.2	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{13} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.8 \times 10^{-7}$	90	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M059R20
NODE=M059R20

$$\Gamma(\eta_c(2S) \rightarrow p \bar{p}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{14} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-6}$	90	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M059R24
NODE=M059R24

$$\Gamma(\eta_c(2S) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{17} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$

NODE=M059R27
NODE=M059R27

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$.

NODE=M059R27;LINKAGE=A

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{18} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.97 \pm 0.81 \pm 0.26$		106	ABLIKIM	23Q BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

NODE=M059R11
NODE=M059R11

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.3	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}}$$

$$\Gamma_{19} / \Gamma \times \Gamma_{183}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M059R12
NODE=M059R12

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<14.2 \times 10^{-6}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta'$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12;LINKAGE=CR

$$\Gamma(K_2^*(1430)\bar{K} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R34
NODE=M059R34

NODE=M059R34;LINKAGE=A

$$\Gamma(a_0(1710)\pi)/\Gamma_{\text{total}} \quad \Gamma_{22}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R37
NODE=M059R37

NODE=M059R37;LINKAGE=A

$$\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R38
NODE=M059R38

NODE=M059R38;LINKAGE=A

$$\Gamma(a_2(1700)\pi)/\Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R39
NODE=M059R39

NODE=M059R39;LINKAGE=A

$$\Gamma(K_0^*(2600)\bar{K} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{25}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R40
NODE=M059R40

NODE=M059R40;LINKAGE=A

$$\Gamma(K_0^*(1950)\bar{K} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{21}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$

¹ From a Dalitz plot analysis of $\eta_c(2S) \rightarrow K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M059R35
NODE=M059R35

NODE=M059R35;LINKAGE=A

$$\Gamma(\eta_c(2S) \rightarrow \pi^+ \pi^- \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma \times \Gamma_{183}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.7 \times 10^{-4}$	90	¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta_c(1S)$

¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

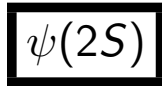
NODE=M059R14
NODE=M059R14

NODE=M059R14;LINKAGE=CR

$\eta_c(2S)$ REFERENCES

NODE=M059

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	23Q	PR D107 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62060
ABLIKIM	22Q	PR D106 032014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61663
CHILIKIN	19	PR D100 012001	K. Chilikin <i>et al.</i>	(BELLE Collab.)	REFID=59899
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE Collab.)	REFID=59453
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55937
ABLIKIM	13K	PR D87 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54956
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55583
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54272
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
ABLIKIM	11H	PR D84 091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53929
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16751
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=53927
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=53233
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52267
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=52064
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=51627
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
AUBERT	05C	PR D72 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50773
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=50182
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=49745
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49746
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49188
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=48760
AMBROGIANI	01	PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=48340
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=46553
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=44623
LEE	85	SLAC 282	R.A. Lee	(SLAC)	REFID=40589
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173



$$J^G(J^{PC}) = 0^-(1^{--})$$

See the Review on “Branching Ratios of $\psi(2S)$, $\chi_{c0,1,2}$ and $\eta_c(1S)$ ” before the $\chi_{c0}(1P)$ Listings.

NODE=M071

NODE=M071

$\psi(2S)$ MASS

NODE=M071M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M071M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3686.097±0.011 OUR FIT		Error includes scale factor of 1.1. [3686.10±0.06 MeV OUR 2023 FIT Scale factor = 5.9]		
3686.097±0.010 OUR AVERAGE				
3686.099±0.004±0.009		¹ ANASHIN	15	KEDR $e^+e^- \rightarrow \text{hadrons}$
3686.12 ±0.06 ±0.10	4k	AAIJ	12H	LHCB $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$
3685.95 ±0.10	413	² ARTAMONOV	00	OLYA $e^+e^- \rightarrow \text{hadrons}$
3685.98 ±0.09 ±0.04		³ ARMSTRONG	93B	E760 $\bar{p}p \rightarrow e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3686.08 ±0.07	1301	⁴ AAIJ	23AP	LHCB $B_s^0 \rightarrow J/\psi 2(\pi^+ \pi^-)$
3686.114±0.007 ^{+0.011} _{-0.016}		⁵ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
3686.111±0.025±0.009		AULCHENKO	03	KEDR $e^+e^- \rightarrow \text{hadrons}$
3686.00 ±0.10	413	⁶ ZHOLENTZ	80	OLYA e^+e^-

NODE=M071M

NEW

¹ Supersedes AULCHENKO 03 and ANASHIN 12.

² Reanalysis of ZHOLENTZ 80 using new electron mass (COHEN 87) and radiative corrections (KURAEV 85).

³ Mass central value and systematic error recalculated by us according to Eq.(16) in ARMSTRONG 93B, using the value for the $J/\psi(1S)$ mass from AULCHENKO 03.

⁴ From a fit of a relativistic S -wave Breit-Wigner convolved with the detector resolution. The width of $\psi(2S)$ is constrained to the PDG 22 value. Systematic errors not evaluated.

⁵ From the scans in 2004 and 2006. ANASHIN 12 reports the value $3686.114 \pm 0.007 \pm 0.011^{+0.002}_{-0.012}$ MeV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

⁶ Superseded by ARTAMONOV 00.

NODE=M071M;LINKAGE=A

NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=B

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=RZ

$m_{\psi(2S)} - m_{J/\psi(1S)}$

NODE=M071DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
589.188±0.028 OUR AVERAGE			
589.194±0.027±0.011	¹ AULCHENKO	03	KEDR $e^+e^- \rightarrow \text{hadrons}$
589.7 ±1.2	LEMOIGNE	82	GOLI $185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
589.07 ±0.13	¹ ZHOLENTZ	80	OLYA e^+e^-
588.7 ±0.8	LUTH	75	MRK1
• • • We do not use the following data for averages, fits, limits, etc. • • •			
588 ±1	² BAI	98E	BES e^+e^-

¹ Redundant with data in mass above.

² Systematic errors not evaluated.

NODE=M071DM;LINKAGE=R

NODE=M071DM;LINKAGE=BD

$\psi(2S)$ WIDTH

NODE=M071W

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
293± 9 OUR FIT		Error includes scale factor of 1.2. [294 ± 8 keV OUR 2023 FIT]		
286±16 OUR AVERAGE				
358±88± 4		ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{hadrons}$
290±25± 4	2.7k	ANDREOTTI	07	E835 $p\bar{p} \rightarrow e^+e^-, J/\psi X$
331±58± 2		ABLIKIM	06L	BES2 $e^+e^- \rightarrow \text{hadrons}$
264±27		¹ BAI	02B	BES2 e^+e^-
287±37±16		² ARMSTRONG	93B	E760 $\bar{p}p \rightarrow e^+e^-$

NODE=M071W

NEW

¹ From a simultaneous fit to the hadronic and $\mu^+ \mu^-$ cross section, assuming $\Gamma = \Gamma_h + \Gamma_e + \Gamma_\mu + \Gamma_\tau$ and lepton universality. Does not include vacuum polarization correction.

² The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

NODE=M071W;LINKAGE=BC

NODE=M071W;LINKAGE=AN

$\psi(2S)$ DECAY MODES

NODE=M071220;NODE=M071

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 hadrons	(97.85 $\pm$ 0.13) %		DESIG=3
Γ_2 virtual $\gamma \rightarrow$ hadrons	(1.79 $\pm$ 0.04) %		DESIG=4
Γ_3 $g g g$	(10.6 $\pm$ 1.6) %		DESIG=255
Γ_4 $\gamma g g$	(1.03 $\pm$ 0.29) %		DESIG=256
Γ_5 light hadrons	(15.4 $\pm$ 1.5) %		DESIG=226
Γ_6 K_S^0 anything	(16.0 $\pm$ 1.1) %		DESIG=325
Γ_7 $e^+ e^-$	(7.94 $\pm$ 0.22) $\times 10^{-3}$	S=1.3	DESIG=1
Γ_8 $\mu^+ \mu^-$	(8.0 $\pm$ 0.6) $\times 10^{-3}$		DESIG=2
Γ_9 $\tau^+ \tau^-$	(3.1 $\pm$ 0.4) $\times 10^{-3}$		DESIG=68
Decays into $J/\psi(1S)$ and anything			
Γ_{10} $J/\psi(1S)$ anything	(61.5 $\pm$ 0.7) %	S=1.3	NODE=M071;CLUMP=A DESIG=11
Γ_{11} $J/\psi(1S)$ neutrals	(25.4 $\pm$ 0.5) %	S=1.6	DESIG=12
Γ_{12} $J/\psi(1S) \pi^+ \pi^-$	(34.69 $\pm$ 0.34) %	S=1.1	DESIG=13
Γ_{13} $J/\psi(1S) \pi^0 \pi^0$	(18.2 $\pm$ 0.5) %	S=1.6	DESIG=14
Γ_{14} $J/\psi(1S) \eta$	(3.37 $\pm$ 0.06) %	S=1.2	DESIG=15
Γ_{15} $J/\psi(1S) \pi^0$	(1.268 $\pm$ 0.032) $\times 10^{-3}$		DESIG=18
Hadronic decays			
Γ_{16} $\pi^+ \pi^-$	(7.8 $\pm$ 2.6) $\times 10^{-6}$		NODE=M071;CLUMP=B DESIG=21
Γ_{17} $\pi^+ \pi^- \pi^0$	(2.01 $\pm$ 0.17) $\times 10^{-4}$	S=1.7	DESIG=36
Γ_{18} $\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	(3.2 $\pm$ 1.2) $\times 10^{-5}$	S=1.8	DESIG=22
Γ_{19} $\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	(1.9 $\pm$ 1.2) $\times 10^{-4}$		DESIG=201
Γ_{20} $2(\pi^+ \pi^-)$	(2.4 $\pm$ 0.6) $\times 10^{-4}$	S=2.2	DESIG=24
Γ_{21} $\rho^0 \pi^+ \pi^-$	(2.2 $\pm$ 0.6) $\times 10^{-4}$	S=1.4	DESIG=33
Γ_{22} $2(\pi^+ \pi^-) \pi^0$	(2.9 $\pm$ 1.0) $\times 10^{-3}$	S=4.7	DESIG=25
Γ_{23} $\rho a_2(1320)$	(2.6 $\pm$ 0.9) $\times 10^{-4}$		DESIG=65
Γ_{24} $\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	(5.3 $\pm$ 1.0) $\times 10^{-3}$		DESIG=312
Γ_{25} $\rho^\pm \pi^\mp \pi^0 \pi^0$	$< 2.7 \times 10^{-3}$	CL=90%	DESIG=315
Γ_{26} $\pi^+ \pi^- 4\pi^0$	(1.4 $\pm$ 1.0) $\times 10^{-3}$		DESIG=332
Γ_{27} $3(\pi^+ \pi^-)$	(3.5 $\pm$ 2.0) $\times 10^{-4}$	S=2.8	DESIG=32
Γ_{28} $2(\pi^+ \pi^- \pi^0)$	(4.8 $\pm$ 1.5) $\times 10^{-3}$		DESIG=221
Γ_{29} $3(\pi^+ \pi^-) \pi^0$	(3.5 $\pm$ 1.6) $\times 10^{-3}$		DESIG=37
Γ_{30} $2(\pi^+ \pi^-) 3\pi^0$	(1.42 $\pm$ 0.31) %		DESIG=329
Γ_{31} $\eta \pi^+ \pi^-$	$< 1.6 \times 10^{-4}$	CL=90%	DESIG=202
Γ_{32} $\eta \pi^+ \pi^- \pi^0$	(9.5 $\pm$ 1.7) $\times 10^{-4}$		DESIG=203
Γ_{33} $\eta 2(\pi^+ \pi^-)$	(1.2 $\pm$ 0.6) $\times 10^{-3}$		DESIG=251
Γ_{34} $\eta \pi^+ \pi^- \pi^0 \pi^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=313
Γ_{35} $\eta \pi^+ \pi^- 3\pi^0$	$< 2.1 \times 10^{-3}$	CL=90%	DESIG=334
Γ_{36} $\eta 2(\pi^+ \pi^- \pi^0)$	$< 2.1 \times 10^{-3}$	CL=90%	DESIG=328
Γ_{37} $\rho \eta$	(2.2 $\pm$ 0.6) $\times 10^{-5}$	S=1.1	DESIG=94
Γ_{38} $\eta' \pi^+ \pi^- \pi^0$	(4.5 $\pm$ 2.1) $\times 10^{-4}$		DESIG=204
Γ_{39} $\eta' \rho$	(1.9 $\pm$ 1.7) $\times 10^{-5}$		DESIG=93
Γ_{40} $\omega \pi^0$	(2.1 $\pm$ 0.6) $\times 10^{-5}$		DESIG=92
Γ_{41} $\omega \pi^+ \pi^-$	(7.3 $\pm$ 1.2) $\times 10^{-4}$	S=2.1	DESIG=75
Γ_{42} $\omega \pi^+ \pi^- 2\pi^0$	(8.7 $\pm$ 2.4) $\times 10^{-3}$		DESIG=327
Γ_{43} $b_1^\pm \pi^\mp$	(4.0 $\pm$ 0.6) $\times 10^{-4}$	S=1.1	DESIG=40
Γ_{44} $\omega f_2(1270)$	(2.2 $\pm$ 0.4) $\times 10^{-4}$		DESIG=64
Γ_{45} $\omega \pi^0 \pi^0$	(1.11 $\pm$ 0.35) $\times 10^{-3}$		DESIG=314
Γ_{46} $\omega 3\pi^0$	$< 8 \times 10^{-4}$	CL=90%	DESIG=333
Γ_{47} $b_1^0 \pi^0$	(2.4 $\pm$ 0.6) $\times 10^{-4}$		DESIG=193
Γ_{48} $\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Γ_{49} $\omega \eta'$	(3.2 $\pm$ 2.5) $\times 10^{-5}$		DESIG=91
Γ_{50} $\phi \pi^0$	$< 4 \times 10^{-7}$	CL=90%	DESIG=96
Γ_{51} $\phi \pi^+ \pi^-$	(1.18 $\pm$ 0.26) $\times 10^{-4}$	S=1.5	DESIG=78
Γ_{52} $\phi f_0(980) \rightarrow \pi^+ \pi^-$	(7.5 $\pm$ 3.3) $\times 10^{-5}$	S=1.6	DESIG=81
Γ_{53} $\phi \eta$	(3.10 $\pm$ 0.31) $\times 10^{-5}$		DESIG=89

Г ₅₄	$\eta\phi(2170), \phi(2170) \rightarrow$ $\phi f_0(980), f_0 \rightarrow \pi^+\pi^-$	< 2.2	$\times 10^{-6}$	CL=90%	DESIG=316
Г ₅₅	$\phi\eta'$	(1.54 ± 0.20)	$\times 10^{-5}$		DESIG=90
Г ₅₆	$\phi f_1(1285)$	(3.0 ± 1.3)	$\times 10^{-5}$		DESIG=319
Г ₅₇	$\phi\eta(1405) \rightarrow \phi\pi^+\pi^-\eta$	(8.5 ± 1.7)	$\times 10^{-6}$		DESIG=320
Г ₅₈	$\phi f'_2(1525)$	(4.4 ± 1.6)	$\times 10^{-5}$		DESIG=67
Г ₅₉	K^+K^-	(7.5 ± 0.5)	$\times 10^{-5}$		DESIG=23
Г ₆₀	$K^+K^-\pi^+\pi^-$	(7.3 ± 0.5)	$\times 10^{-4}$		DESIG=26
Г ₆₁	$K^+K^-\pi^0$	(4.07 ± 0.31)	$\times 10^{-5}$		DESIG=38
Г ₆₂	$K_S^0 K_S^0$	< 4.6	$\times 10^{-6}$		DESIG=86
Г ₆₃	$K_S^0 K_L^0$	(5.34 ± 0.33)	$\times 10^{-5}$		DESIG=85
Г ₆₄	$K_S^0 K_L^0 \pi^0$	< 3.0	$\times 10^{-4}$	CL=90%	DESIG=303
Г ₆₅	$K^+K^-\pi^0\pi^0$	(2.6 ± 1.3)	$\times 10^{-4}$		DESIG=298
Г ₆₆	$K^+K^-\pi^0\pi^0\pi^0$	(6.6 ± 2.8)	$\times 10^{-4}$		DESIG=341
Г ₆₇	$K_S^0 K^\pm \pi^\mp \pi^0 \pi^0$	(1.7 ± 0.6)	$\times 10^{-3}$		DESIG=342
Г ₆₈	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	(2.2 ± 0.4)	$\times 10^{-3}$		DESIG=343
Г ₆₉	$K^+K^-\pi^+\pi^-\pi^0$	(1.26 ± 0.09)	$\times 10^{-3}$		DESIG=206
Г ₇₀	$\omega f_0(1710) \rightarrow \omega K^+K^-$	(5.9 ± 2.2)	$\times 10^{-5}$		DESIG=216
Г ₇₁	$K^*(892)^0 K^-\pi^+\pi^0 + \text{c.c.}$	(8.6 ± 2.2)	$\times 10^{-4}$		DESIG=217
Г ₇₂	$K^*(892)^+ K^-\pi^+\pi^- + \text{c.c.}$	(9.6 ± 2.8)	$\times 10^{-4}$		DESIG=218
Г ₇₃	$K^*(892)^+ K^-\rho^0 + \text{c.c.}$	(7.3 ± 2.6)	$\times 10^{-4}$		DESIG=219
Г ₇₄	$K^*(892)^0 K^-\rho^+ + \text{c.c.}$	(6.1 ± 1.8)	$\times 10^{-4}$		DESIG=220
Г ₇₅	$K_S^0 K_S^0 \pi^+\pi^-$	(2.2 ± 0.4)	$\times 10^{-4}$		DESIG=225
Г ₇₆	$K_S^0 K_L^0 \pi^0 \pi^0$	(1.3 ± 0.6)	$\times 10^{-3}$		DESIG=304
Г ₇₇	$K_S^0 K^*(892)^0 \pi^0 \pi^0$	(3.0 ± 1.3)	$\times 10^{-4}$		DESIG=348
Г ₇₈	$K_S^0 K^\pm \rho(770)^\mp \pi^0$	< 7	$\times 10^{-4}$	CL=90%	DESIG=352
Г ₇₉	$K_S^0 K^\pm \pi^\mp \rho(770)^0$	< 7	$\times 10^{-4}$	CL=90%	DESIG=353
Г ₈₀	$K^\mp K^*(892)^\pm \pi^0 \pi^0$	(7.0 ± 2.9)	$\times 10^{-4}$		DESIG=349
Г ₈₁	$K^*(892)^+ K^*(892)^- \pi^0$	(3.6 ± 1.8)	$\times 10^{-3}$		DESIG=350
Г ₈₂	$K_S^0 K_L^0 \eta$	(1.3 ± 0.5)	$\times 10^{-3}$		DESIG=305
Г ₈₃	$K^+K^-\rho^0$	(2.2 ± 0.4)	$\times 10^{-4}$		DESIG=205
Г ₈₄	$K^*(892)^0 \bar{K}_2^*(1430)^0$	(1.9 ± 0.5)	$\times 10^{-4}$		DESIG=66
Г ₈₅	$K^+K^-\pi^+\pi^-\eta$	(1.3 ± 0.7)	$\times 10^{-3}$		DESIG=252
Г ₈₆	$K^+K^-2(\pi^+\pi^-)$	(1.9 ± 0.9)	$\times 10^{-3}$		DESIG=222
Г ₈₇	$K^+K^-2(\pi^+\pi^-)\pi^0$	(1.00 ± 0.31)	$\times 10^{-3}$		DESIG=240
Г ₈₈	$K^+K^*(892)^- + \text{c.c.}$	(2.9 ± 0.4)	$\times 10^{-5}$	S=1.2	DESIG=39
Г ₈₉	$2(K^+K^-)$	(6.3 ± 1.3)	$\times 10^{-5}$		DESIG=208
Г ₉₀	$2(K^+K^-)\pi^0$	(1.10 ± 0.28)	$\times 10^{-4}$		DESIG=209
Г ₉₁	$K^+K^-\phi$	(7.0 ± 1.6)	$\times 10^{-5}$		DESIG=79
Г ₉₂	$K_S^0 K_S^0 \phi$	(3.53 ± 0.29)	$\times 10^{-5}$		DESIG=347
Г ₉₃	$K_1(1270)^\pm K^\mp$	(1.00 ± 0.28)	$\times 10^{-3}$		DESIG=41
Г ₉₄	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	(6.7 ± 2.5)	$\times 10^{-4}$		DESIG=34
Г ₉₅	$\eta K^+K^-, \text{ no } \eta\phi$	(3.49 ± 0.17)	$\times 10^{-5}$		DESIG=207
Г ₉₆	ηK^+K^-	< 2.6	$\times 10^{-4}$	CL=90%	DESIG=351
Г ₉₇	$X(1750)\eta \rightarrow K^+K^-\eta$	(4.8 ± 2.8)	$\times 10^{-6}$		DESIG=324
Г ₉₈	$K_1(1400)^\pm K^\mp$	< 3.1	$\times 10^{-4}$	CL=90%	DESIG=42
Г ₉₉	$K_2^*(1430)^\pm K^\mp$	(7.1 ± 1.3 -0.9)	$\times 10^{-5}$		DESIG=265
Г ₁₀₀	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(1.09 ± 0.20)	$\times 10^{-4}$		DESIG=194
Г ₁₀₁	ωK^+K^-	(1.62 ± 0.11)	$\times 10^{-4}$	S=1.1	DESIG=76
Г ₁₀₂	$\omega K_S^0 K_S^0$	(7.0 ± 0.5)	$\times 10^{-5}$		DESIG=330
Г ₁₀₃	$\omega K^*(892)^+ K^- + \text{c.c.}$	(2.07 ± 0.26)	$\times 10^{-4}$		DESIG=276
Г ₁₀₄	$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	(6.1 ± 1.2)	$\times 10^{-5}$		DESIG=277
Г ₁₀₅	$\omega \bar{K}^*(892)^0 K^0$	(1.68 ± 0.30)	$\times 10^{-4}$		DESIG=278
Г ₁₀₆	$\omega \bar{K}_2^*(1430)^0 K^0$	(5.8 ± 2.2)	$\times 10^{-5}$		DESIG=279
Г ₁₀₇	$\omega X(1440) \rightarrow \omega K_S^0 K^-\pi^+ +$ c.c.	(1.6 ± 0.4)	$\times 10^{-5}$		DESIG=282

Γ_{108}	$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		DESIG=283
Γ_{109}	$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ +$ c.c.	$(3.0 \pm 1.0) \times 10^{-6}$		DESIG=284
Γ_{110}	$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$		DESIG=285
Γ_{111}	$\rho \bar{\rho}$	$(2.94 \pm 0.09) \times 10^{-4}$	S=1.3	DESIG=27
Γ_{112}	$n \bar{n}$	$(3.06 \pm 0.15) \times 10^{-4}$		DESIG=309
Γ_{113}	$\rho \bar{\rho} \pi^0$	$(1.53 \pm 0.07) \times 10^{-4}$		DESIG=35
Γ_{114}	$N(940) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(6.4 \pm 1.8_{-1.3}) \times 10^{-5}$		DESIG=267
Γ_{115}	$N(1440) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(7.3 \pm 1.7_{-1.5}) \times 10^{-5}$	S=2.5	DESIG=261
Γ_{116}	$N(1520) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(6.4 \pm 2.3_{-1.8}) \times 10^{-6}$		DESIG=268
Γ_{117}	$N(1535) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(2.5 \pm 1.0) \times 10^{-5}$		DESIG=269
Γ_{118}	$N(1650) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(3.8 \pm 1.4_{-1.7}) \times 10^{-5}$		DESIG=270
Γ_{119}	$N(1720) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(1.79 \pm 0.26_{-0.70}) \times 10^{-5}$		DESIG=271
Γ_{120}	$N(2300) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(2.6 \pm 1.2_{-0.7}) \times 10^{-5}$		DESIG=272
Γ_{121}	$N(2570) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \pi^0$	$(2.13 \pm 0.40_{-0.31}) \times 10^{-5}$		DESIG=273
Γ_{122}	$\rho \bar{\rho} \pi^+ \pi^-$	$(6.0 \pm 0.4) \times 10^{-4}$		DESIG=31
Γ_{123}	$\rho \bar{\rho} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Γ_{124}	$\rho \bar{\rho} \eta$	$(6.0 \pm 0.4) \times 10^{-5}$		DESIG=200
Γ_{125}	$N(1535) \bar{p} + \text{c.c.} \rightarrow \rho \bar{\rho} \eta$	$(4.5 \pm 0.7_{-0.6}) \times 10^{-5}$		DESIG=264
Γ_{126}	$\rho \bar{\rho} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Γ_{127}	$\rho \bar{\rho} \rho^0$	$(5.0 \pm 2.2) \times 10^{-5}$		DESIG=210
Γ_{128}	$\rho \bar{\rho} \omega$	$(6.9 \pm 2.1) \times 10^{-5}$		DESIG=77
Γ_{129}	$\rho \bar{\rho} \eta'$	$(1.10 \pm 0.13) \times 10^{-5}$		DESIG=317
Γ_{130}	$\rho \bar{\rho} \phi$	$(6.1 \pm 0.6) \times 10^{-6}$		DESIG=80
Γ_{131}	$\phi X(1835) \rightarrow \rho \bar{\rho} \phi$	$< 1.82 \times 10^{-7}$	CL=90%	DESIG=318
Γ_{132}	$\rho \bar{n} \pi^- \text{ or c.c.}$	$(2.48 \pm 0.17) \times 10^{-4}$		DESIG=227
Γ_{133}	$\rho \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		DESIG=228
Γ_{134}	$\Lambda \bar{\Lambda}$	$(3.81 \pm 0.13) \times 10^{-4}$	S=1.4	DESIG=28
Γ_{135}	$\Lambda \bar{\Lambda} \pi^0$	$(1.4 \pm 0.7) \times 10^{-6}$		DESIG=238
Γ_{136}	$\Lambda \bar{\Lambda} \eta$	$(2.43 \pm 0.32) \times 10^{-5}$		DESIG=239
Γ_{137}	$\Lambda(1670) \bar{\Lambda} \rightarrow \Lambda \bar{\Lambda} \eta$	$(1.3 \pm 0.7) \times 10^{-5}$		DESIG=336
Γ_{138}	$\Lambda \bar{\Lambda} \eta'$	$(7.3 \pm 1.0) \times 10^{-6}$		DESIG=346
Γ_{139}	$\Lambda \bar{\Lambda} \omega(782)$	$(3.3 \pm 0.4) \times 10^{-5}$		DESIG=340
Γ_{140}	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$		DESIG=213
Γ_{141}	$\Lambda \bar{p} K^+$	$(1.00 \pm 0.14) \times 10^{-4}$		DESIG=214
Γ_{142}	$\Lambda \bar{p} K^*(892)^+ + \text{c.c.}$	$(6.3 \pm 0.7) \times 10^{-5}$		DESIG=321
Γ_{143}	$\Lambda \bar{p} K^+ \pi^+ \pi^-$	$(1.8 \pm 0.4) \times 10^{-4}$		DESIG=215
Γ_{144}	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Γ_{145}	$\Delta^{++} \bar{\Delta}^{--}$	$(1.28 \pm 0.35) \times 10^{-4}$		DESIG=70
Γ_{146}	$\Lambda \bar{\Sigma}^+ \pi^- + \text{c.c.}$	$(1.40 \pm 0.13) \times 10^{-4}$		DESIG=280
Γ_{147}	$\Lambda \bar{\Sigma}^- \pi^+ + \text{c.c.}$	$(1.54 \pm 0.14) \times 10^{-4}$		DESIG=281
Γ_{148}	$\Lambda \bar{\Sigma}^0 + \text{c.c.}$	$(1.6 \pm 0.7) \times 10^{-6}$		DESIG=326
Γ_{149}	$\Lambda \bar{\Sigma}^0$			DESIG=307
Γ_{150}	$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(1.67 \pm 0.18) \times 10^{-5}$		DESIG=274
Γ_{151}	$\Sigma^+ \bar{\Sigma}^-$	$(2.43 \pm 0.10) \times 10^{-4}$	S=1.4	DESIG=223
Γ_{152}	$\Sigma^0 \bar{\Sigma}^0$	$(2.35 \pm 0.09) \times 10^{-4}$	S=1.1	DESIG=71
Γ_{153}	$\Sigma^- \bar{\Sigma}^+$	$(2.82 \pm 0.09) \times 10^{-4}$		DESIG=335
Γ_{154}	$\Sigma^+ \bar{\Sigma}^- \eta$	$(9.6 \pm 2.4) \times 10^{-6}$		DESIG=339
Γ_{155}	$\Sigma^+ \bar{\Sigma}^- \omega$	$(1.89 \pm 0.28) \times 10^{-5}$		DESIG=344
Γ_{156}	$\Sigma^+ \bar{\Sigma}^- \phi$	$(3.0 \pm 0.7) \times 10^{-6}$		DESIG=345
Γ_{157}	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$(8.5 \pm 0.7) \times 10^{-5}$		DESIG=72
Γ_{158}	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$(8.5 \pm 0.8) \times 10^{-5}$		DESIG=297
Γ_{159}	$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	$(6.9 \pm 0.7) \times 10^{-5}$		DESIG=299

Γ_{160}	$\Xi^- \Xi^+$	$(2.87 \pm 0.11) \times 10^{-4}$	S=1.1	DESIG=29
Γ_{161}	$\Xi^0 \Xi^0$	$(2.3 \pm 0.4) \times 10^{-4}$	S=4.2	DESIG=224
Γ_{162}	$\Xi(1530)^0 \Xi(1530)^0$	$(6.8 \pm 0.4) \times 10^{-5}$		DESIG=73
Γ_{163}	$\Lambda \Xi^+ K^- + \text{c.c.}$	$(3.9 \pm 0.4) \times 10^{-5}$		DESIG=293
Γ_{164}	$\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$	$(5.2 \pm 1.6) \times 10^{-6}$		DESIG=294
Γ_{165}	$\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$	$(1.20 \pm 0.32) \times 10^{-5}$		DESIG=295
Γ_{166}	$\Xi(1530)^- \Xi(1530)^+$	$(1.15 \pm 0.07) \times 10^{-4}$		DESIG=322
Γ_{167}	$\Xi(1530)^- \Xi^+$	$(7.0 \pm 1.2) \times 10^{-6}$		DESIG=323
Γ_{168}	$\Xi(1530)^0 \Xi^0$	$(5.3 \pm 0.5) \times 10^{-6}$		DESIG=331
Γ_{169}	$\Sigma^0 \Xi^+ K^- + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		DESIG=296
Γ_{170}	$\Omega^- \bar{\Omega}^+$	$(5.66 \pm 0.30) \times 10^{-5}$	S=1.3	DESIG=74
Γ_{171}	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Γ_{172}	$h_c(1P) \pi^0$	$(7.4 \pm 0.5) \times 10^{-4}$		DESIG=254
Γ_{173}	$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	$< 1.7 \times 10^{-6}$	CL=90%	DESIG=310
Γ_{174}	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$[a] < 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Γ_{175}	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$[a] < 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Γ_{176}	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$[a] < 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Γ_{177}	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$[a] < 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Γ_{178}	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$[a] < 6.0 \times 10^{-6}$	CL=90%	DESIG=199

Radiative decays

NODE=M071;CLUMP=C

Γ_{179}	$\gamma \chi_{c0}(1P)$	$(9.77 \pm 0.23) \%$	S=1.1	DESIG=56
Γ_{180}	$\gamma \chi_{c1}(1P)$	$(9.75 \pm 0.27) \%$	S=1.1	DESIG=58
Γ_{181}	$\gamma \chi_{c2}(1P)$	$(9.36 \pm 0.23) \%$	S=1.2	DESIG=59
Γ_{182}	$\gamma \eta_c(1S)$	$(3.6 \pm 0.5) \times 10^{-3}$	S=1.3	DESIG=61
Γ_{183}	$\gamma \eta_c(2S)$	$(7 \pm 5) \times 10^{-4}$		DESIG=63
Γ_{184}	$\gamma \pi^0$	$(1.04 \pm 0.22) \times 10^{-6}$	S=1.4	DESIG=52
Γ_{185}	$\gamma 2(\pi^+ \pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		DESIG=241
Γ_{186}	$\gamma 3(\pi^+ \pi^-)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=249
Γ_{187}	$\gamma \eta'(958)$	$(1.24 \pm 0.04) \times 10^{-4}$		DESIG=54
Γ_{188}	$\gamma f_2(1270)$	$(2.73 \pm 0.29 \pm 0.25) \times 10^{-4}$	S=1.8	DESIG=82
Γ_{189}	$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(3.1 \pm 1.7) \times 10^{-5}$		DESIG=286
Γ_{190}	$\gamma f_0(1500)$	$(9.3 \pm 1.9) \times 10^{-5}$		DESIG=287
Γ_{191}	$\gamma f_2'(1525)$	$(3.3 \pm 0.8) \times 10^{-5}$		DESIG=288
Γ_{192}	$\gamma f_0(1710)$	seen		DESIG=236;OUR EST;→ UNCHECKED ←
Γ_{193}	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.5 \pm 0.6) \times 10^{-5}$		DESIG=83
Γ_{194}	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(6.6 \pm 0.7) \times 10^{-5}$		DESIG=84
Γ_{195}	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(4.8 \pm 1.0) \times 10^{-6}$		DESIG=289
Γ_{196}	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(3.2 \pm 1.0) \times 10^{-6}$		DESIG=290
Γ_{197}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	$< 5.8 \times 10^{-6}$	CL=90%	DESIG=291
Γ_{198}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	$< 9.5 \times 10^{-6}$	CL=90%	DESIG=292
Γ_{199}	$\gamma \eta$	$(9.2 \pm 1.8) \times 10^{-7}$		DESIG=53
Γ_{200}	$\gamma \eta \pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		DESIG=230
Γ_{201}	$\gamma \eta(1405)$	seen		DESIG=231;OUR EST;→ UNCHECKED ←
Γ_{202}	$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	$< 9 \times 10^{-5}$	CL=90%	DESIG=62
Γ_{203}	$\gamma \eta(1405) \rightarrow \gamma \eta \pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		DESIG=232
Γ_{204}	$\gamma \eta(1405) \rightarrow \gamma f_0(980) \pi^0 \rightarrow \gamma \pi^+ \pi^- \pi^0$	$< 5.0 \times 10^{-7}$	CL=90%	DESIG=308
Γ_{205}	$\gamma \eta(1475)$	seen		DESIG=233;OUR EST;→ UNCHECKED ←
Γ_{206}	$\gamma \eta(1475) \rightarrow \gamma K \bar{K} \pi$	$< 1.4 \times 10^{-4}$	CL=90%	DESIG=234
Γ_{207}	$\gamma \eta(1475) \rightarrow \gamma \eta \pi^+ \pi^-$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=235
Γ_{208}	$\gamma K^{*0} K^+ \pi^- + \text{c.c.}$	$(3.7 \pm 0.9) \times 10^{-4}$		DESIG=242
Γ_{209}	$\gamma K^{*0} \bar{K}^{*0}$	$(2.4 \pm 0.7) \times 10^{-4}$		DESIG=243

Γ_{210}	$\gamma K_S^0 K^+ \pi^- + \text{c.c.}$	$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=244
Γ_{211}	$\gamma K^+ K^- \pi^+ \pi^-$	$(1.9 \pm 0.5) \times 10^{-4}$		DESIG=245
Γ_{212}	$\gamma K^+ K^- 2(\pi^+ \pi^-)$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=248
Γ_{213}	$\gamma 2(K^+ K^-)$	$< 4 \times 10^{-5}$	CL=90%	DESIG=250
Γ_{214}	$\gamma p \bar{p}$	$(3.9 \pm 0.5) \times 10^{-5}$	S=2.0	DESIG=246
Γ_{215}	$\gamma f_2(1950) \rightarrow \gamma p \bar{p}$	$(1.20 \pm 0.22) \times 10^{-5}$		DESIG=257
Γ_{216}	$\gamma f_2(2150) \rightarrow \gamma p \bar{p}$	$(7.2 \pm 1.8) \times 10^{-6}$		DESIG=258
Γ_{217}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(4.6 \pm 1.8_{-4.0}^+) \times 10^{-6}$		DESIG=259
Γ_{218}	$\gamma X \rightarrow \gamma p \bar{p}$	$[b] < 2 \times 10^{-6}$	CL=90%	DESIG=260
Γ_{219}	$\gamma p \bar{p} \pi^+ \pi^-$	$(2.8 \pm 1.4) \times 10^{-5}$		DESIG=247
Γ_{220}	$\gamma \gamma$	$< 1.5 \times 10^{-4}$	CL=90%	DESIG=51
Γ_{221}	$\gamma \gamma J/\psi$	$(3.1 \pm 1.0_{-1.2}^+) \times 10^{-4}$		DESIG=266
Γ_{222}	$e^+ e^- \eta'$	$(1.90 \pm 0.26) \times 10^{-6}$		DESIG=311
Γ_{223}	$e^+ e^- \eta_c(1S)$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=338
Γ_{224}	$e^+ e^- \chi_{c0}(1P)$	$(1.06 \pm 0.25) \times 10^{-3}$		DESIG=300
Γ_{225}	$e^+ e^- \chi_{c1}(1P)$	$(8.5 \pm 0.7) \times 10^{-4}$		DESIG=301
Γ_{226}	$e^+ e^- \chi_{c2}(1P)$	$(6.8 \pm 0.8) \times 10^{-4}$		DESIG=302
Weak decays				
Γ_{227}	$D^0 e^+ e^- + \text{c.c.}$	$< 1.4 \times 10^{-7}$	CL=90%	NODE=M071;CLUMP=E DESIG=306
Γ_{228}	$\Lambda_c^+ \bar{\Sigma}^- + \text{c.c.}$	$< 1.4 \times 10^{-5}$	CL=90%	DESIG=337
Other decays				
Γ_{229}	invisible	$< 1.6 \%$	CL=90%	NODE=M071;CLUMP=D DESIG=275

[a] $\Theta(1540)$ is a hypothetical pentaquark state of $1.54 \text{ GeV}/c^2$ mass and a width of less than $25 \text{ MeV}/c^2$.

LINKAGE=THT

[b] For a narrow resonance in the range $2.2 < M(X) < 2.8 \text{ GeV}$.

LINKAGE=NMR

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 86 branching ratios uses 253 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 389.6$ for 204 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_8	3									
x_9	0	0								
x_{12}	21	13	2							
x_{13}	22	5	1	28						
x_{14}	11	6	1	44	11					
x_{111}	0	0	0	3	2	1				
x_{179}	0	0	0	2	1	1	0			
x_{180}	1	0	0	2	0	1	0	0		
x_{181}	1	1	0	4	0	2	0	0	0	
Γ	-85	-4	-1	-29	-31	-15	-4	-1	-1	-2
	x_7	x_8	x_9	x_{12}	x_{13}	x_{14}	x_{111}	x_{179}	x_{180}	x_{181}

FIT INFORMATION

A multiparticle fit to $\eta_c(1S)$, $J/\psi(1S)$, $\psi(2S)$, $h_c(1P)$, and $B^\pm$ with the total width, 10 combinations of partial widths obtained from integrated cross section, and 38 branching ratios uses 113 measurements to determine 19 parameters. The overall fit has a $\chi^2 = 184.6$ for 94 degrees of freedom.

$\psi(2S)$ PARTIAL WIDTHS

NODE=M071225

 $\Gamma(\text{hadrons})$ Γ_1

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
258 ± 26	BAI	02B	BES2 e^+e^-
224 ± 56	LUTH	75	MRK1 e^+e^-

NODE=M071W3
NODE=M071W3 $\Gamma(e^+e^-)$ Γ_7

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.33 ± 0.04 OUR FIT	Error includes scale factor of 1.1. [2.33 ± 0.04 keV OUR 2023 FIT]		
2.29 ± 0.06 OUR AVERAGE			
2.23 ± 0.10 ± 0.02	¹ ABLIKIM	15V	BES3 $4.0-4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
2.338 ± 0.037 ± 0.096	ABLIKIM	08B	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.330 ± 0.036 ± 0.110	ABLIKIM	06L	BES2 $e^+e^- \rightarrow \text{hadrons}$
2.44 ± 0.21	² BAI	02B	BES2 e^+e^-
2.14 ± 0.21	ALEXANDER	89	RVUE See $\mathcal{T}$ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.279 ± 0.015 ± 0.042	³ ANASHIN	18	KEDR e^+e^-
2.282 ± 0.015 ± 0.042	⁴ ANASHIN	18	KEDR e^+e^-
2.0 ± 0.3	BRANDELIK	79C	DASP e^+e^-
2.1 ± 0.3	⁵ LUTH	75	MRK1 e^+e^-

NODE=M071W1
NODE=M071W1

NEW

OCCUR=2

¹ ABLIKIM 15V reports $2.213 \pm 0.018 \pm 0.099$ keV from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^-)] \times [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)]$ assuming $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.95 \pm 0.45) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071W1;LINKAGE=A

² From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channel, assuming $\Gamma_e = \Gamma_\mu = \Gamma_\tau/0.38847$.

NODE=M071W;LINKAGE=BB

³ Combining $\Gamma_{e^+e^-} \cdot B(\mu^+\mu^-)$ from ANASHIN 18 with $\Gamma_{e^+e^-} \cdot B(\text{hadrons})$ from ANASHIN 12 and assuming lepton universality.

NODE=M071W1;LINKAGE=B

⁴ From the sum of $\Gamma_{e^+e^-} \cdot B(\text{hadrons})$ from ANASHIN 12, $\Gamma_{e^+e^-} \cdot B(e^+e^-)$ and $\Gamma_{e^+e^-} \cdot B(\mu^+\mu^-)$ from ANASHIN 18, and $\Gamma_{e^+e^-} \cdot B(\tau^+\tau^-)$ from ANASHIN 07.

NODE=M071W1;LINKAGE=C

⁵ From a simultaneous fit to e^+e^- , $\mu^+\mu^-$, and hadronic channels assuming $\Gamma(e^+e^-) = \Gamma(\mu^+\mu^-)$.

NODE=M071W1;LINKAGE=F

 $\Gamma(\gamma\gamma)$ Γ_{220}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	BRANDELIK	79C	DASP e^+e^-

NODE=M071W51
NODE=M071W51 $\psi(2S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M071230

This combination of a partial width with the partial width into e^+e^- and with the total width is obtained from the integrated cross section into channel(i) in the e^+e^- annihilation. We list only data that have not been used to determine the partial width $\Gamma(i)$ or the branching ratio $\Gamma(i)/\text{total}$.

NODE=M071230

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_7/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.233 ± 0.015 ± 0.042	¹ ANASHIN	12	KEDR $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.2 ± 0.4	ABRAMS	75	MRK1 e^+e^-

NODE=M071G3
NODE=M071G3

¹ ANASHIN 12 reports the value $2.233 \pm 0.015 \pm 0.037 \pm 0.020$ keV, where the third uncertainty is due to assumptions on the interference between the resonance and hadronic continuum. We combined the two systematic uncertainties.

NODE=M071G3;LINKAGE=AN

 $\Gamma(K_S^0 \text{ anything}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_6\Gamma_7/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.3738 ± 0.0067 ± 0.0200	ABLIKIM	21S	BES3 $e^+e^- \rightarrow K_S^0 \text{ anything}$

NODE=M071P30
NODE=M071P30 $\Gamma(e^+e^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_7/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
21.2 ± 0.7 ± 1.2	¹ ANASHIN	18	KEDR e^+e^-

NODE=M071P14
NODE=M071P14

¹ From the average of nine scans of the $\psi(2S)$.

NODE=M071P14;LINKAGE=A

$$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_8\Gamma_7/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
19.3±0.3±0.5	¹ ANASHIN	18	KEDR $\psi(2S) \rightarrow \mu^+\mu^-$

¹ From the average of nine scans of the $\psi(2S)$.

NODE=M071P13
NODE=M071P13

NODE=M071P13;LINKAGE=A

$$\Gamma(\tau^+\tau^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_9\Gamma_7/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

9.0±2.6 79 ¹ ANASHIN 07 KEDR $e^+e^- \rightarrow \psi(2S) \rightarrow \tau^+\tau^-$

¹ Using $\psi(2S)$ total width of 337 ± 13 keV. Systematic errors not evaluated.

NODE=M071G9
NODE=M071G9

NODE=M071G9;LINKAGE=AN

$$\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_7/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.808±0.014 OUR FIT Error includes scale factor of 1.1. [0.808±0.013 keV OUR 2023 FIT]

0.836±0.025 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below. [0.837±0.025 keV OUR 2023 AVERAGE Scale factor = 1.3]

0.78 ±0.12 ±0.07 ¹ LEES 23 BABR $e^+e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

0.837±0.028±0.005 ² LEES 12E BABR $10.6 e^+e^- \rightarrow 2\pi^+2\pi^-\gamma$

0.852±0.010±0.026 19.5k ADAM 06 CLEO $3.773 e^+e^- \rightarrow \gamma\psi(2S)$

0.68 ±0.09 ³ BAI 98E BES e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.93 ±0.08 ±0.03 256 ⁴ AUBERT 07AU BABR $10.6 e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

0.755±0.048±0.004 544 ⁵ AUBERT 05D BABR $10.6 e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-\gamma$

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow K_S^0 K^\pm\pi^\mp)] = (4.14 \pm 0.55 \pm 0.29) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K_S^0 K^\pm\pi^\mp) = (5.3 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² LEES 12E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = (49.9 \pm 1.3 \pm 1.0) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ The value of $\Gamma(e^+e^-)$ quoted in BAI 98E is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6) \times 10^{-2}$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1203 \pm 0.0038$. Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

⁴ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)] = 0.0186 \pm 0.0012 \pm 0.0011$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.00 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ AUBERT 05D reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+\mu^-)] = 0.0450 \pm 0.0018 \pm 0.0022$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Superseded by LEES 12E.

NODE=M071G1
NODE=M071G1

NEW

NEW

NODE=M071G1;LINKAGE=B

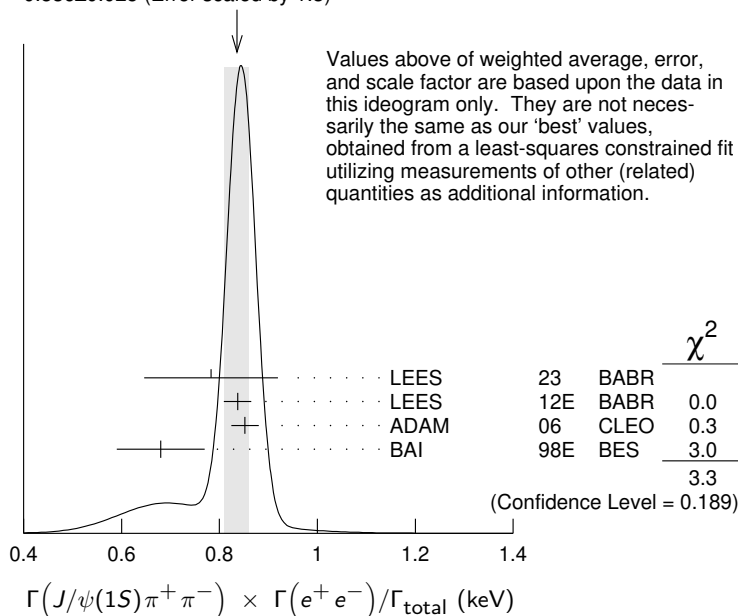
NODE=M071G1;LINKAGE=LE

NODE=M071G1;LINKAGE=A

NODE=M071G1;LINKAGE=UB

NODE=M071G1;LINKAGE=AU

WEIGHTED AVERAGE
0.836±0.025 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_7/\Gamma$

VALUE (keV) EVTS DOCUMENT ID TECN COMMENT
0.425±0.012 OUR FIT Error includes scale factor of 1.4. [0.425 ± 0.009 keV OUR 2023 FIT]

0.413±0.019 OUR AVERAGE

[0.411 ± 0.020 keV OUR 2023 AVERAGE]

0.45 ± 0.13 ± 0.02	1	LEES	23	BABR	$e^+e^- \rightarrow \gamma_{ISR} \text{hadrons}$
0.45 ± 0.12 ± 0.04	2	LEES	23	BABR	$e^+e^- \rightarrow \gamma_{ISR} \text{hadrons}$
0.411±0.008±0.018 3.6k		ADAM	06	CLEO	$3.773 e^+e^- \rightarrow \gamma\psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.51 ± 0.09 ± 0.02 142 ³ LEES 18E BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^0\pi^0\gamma$

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow K^+K^-\pi^0)] = (1.31 \pm 0.35 \pm 0.13) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K^+K^-\pi^0) = (2.88 \pm 0.12) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² LEES 23 reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow K_S^0 K^\pm \pi^\mp)] = (2.36 \pm 0.59 \pm 0.24) \times 10^{-3}$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = (5.3 \pm 0.5) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ LEES 18E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)] = 0.0101 \pm 0.0015 \pm 0.0011$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.00 \pm 0.07) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_7/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT
78.6± 1.8 OUR FIT Error includes scale factor of 1.1. [78.6 ± 1.6 eV OUR 2023 FIT]

87 ± 9 OUR AVERAGE

83 ± 25 ± 5	14	¹ AUBERT	07AU	BABR	$10.6 e^+e^- \rightarrow J/\psi\pi^+\pi^-\pi^0\gamma$
88 ± 6 ± 7 291 ± 24		ADAM	06	CLEO	$3.773 e^+e^- \rightarrow \gamma\psi(2S)$

¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07$ eV.

$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_7/\Gamma$

VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT
<8 90 <37 ADAM 06 CLEO $3.773 e^+e^- \rightarrow \gamma\psi(2S)$

$\Gamma(2\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_7/\Gamma$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT
29.7±2.2±1.8 410 AUBERT 07AU BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$

NODE=M071G6
 NODE=M071G6

NEW

NEW

OCCUR=2

NODE=M071G6;LINKAGE=C

NODE=M071G6;LINKAGE=D

NODE=M071G6;LINKAGE=A

NODE=M071G7
 NODE=M071G7

NEW

NODE=M071G7;LINKAGE=UB

NODE=M071G8
 NODE=M071G8

NODE=M071G01
 NODE=M071G01

$$\Gamma(\pi^+\pi^-\pi^0\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
12.4±1.8±1.2	177	LEES	18E BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

NODE=M071P16
NODE=M071P16

$$\Gamma(\pi^+\pi^-4\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.3±2.3±0.5	18	LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M071P36
NODE=M071P36

$$\Gamma(\rho^\pm\pi^\mp\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.2	90	LEES	18E BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

NODE=M071P18
NODE=M071P18

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
11.2±3.3±1.3	43	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$

NODE=M071G4
NODE=M071G4

$$\Gamma(2(\pi^+\pi^-)3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{30}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
33±5±5	14k	LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M071P31
NODE=M071P31

$$\Gamma(\eta 2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{33}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.87±1.41±0.01		16	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)\eta\gamma$

NODE=M071G03
NODE=M071G03

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	14k	² LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.13 \pm 0.55 \pm 0.08$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G03;LINKAGE=UB

² LEES 21 reports $[\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] < 2.3$ eV which we divide by our best value $B(\eta \rightarrow 3\pi^0) = 32.57 \times 10^{-2}$.

NODE=M071G03;LINKAGE=A

$$\Gamma(\eta\pi^+\pi^-\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{34}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.85	90	LEES	18E BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0\eta\gamma$

NODE=M071P15
NODE=M071P15

$$\Gamma(\eta\pi^+\pi^-3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{35}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-3\pi^0\gamma\gamma)$

NODE=M071P40
NODE=M071P40

¹ LEES 21C reports $[\Gamma(\psi(2S) \rightarrow \eta\pi^+\pi^-3\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 1.9$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M071P40;LINKAGE=A

$$\Gamma(\eta 2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{36}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<5	90	14k	¹ LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M071P33
NODE=M071P33

¹ LEES 21 reports $[\Gamma(\psi(2S) \rightarrow \eta 2(\pi^+\pi^-\pi^0)) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] < 1.9$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = 39.36 \times 10^{-2}$.

NODE=M071P33;LINKAGE=A

$$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.01±0.84±0.02	37	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$

NODE=M071G02
NODE=M071G02

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.69 \pm 0.73 \pm 0.16$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G02;LINKAGE=UB

$$\Gamma(\omega\pi^+\pi^-2\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{42}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
20.2±5.6±0.1	14k	¹ LEES	21 BABR	10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)3\pi^0\gamma$

NODE=M071P32
NODE=M071P32

¹ LEES 21 reports $[\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-2\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 18 \pm 4 \pm 3$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P32;LINKAGE=A

$$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.58±0.82±0.02	33	¹ LEES	18E BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$

NODE=M071P17
NODE=M071P17

¹ LEES 18E reports $[\Gamma(\psi(2S) \rightarrow \omega\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.3 \pm 0.7 \pm 0.2$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P17;LINKAGE=A

$$\Gamma(\omega3\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_7/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ LEES	21C BABR	$e^+e^- \rightarrow \gamma_{ISR}(\pi^+\pi^-4\pi^0)$

NODE=M071P39
NODE=M071P39

¹ LEES 21C reports $[\Gamma(\psi(2S) \rightarrow \omega3\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] < 1.6$ eV which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = 89.2 \times 10^{-2}$.

NODE=M071P39;LINKAGE=A

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.55±0.19±0.01	19	¹ LEES	12F BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M071G10
NODE=M071G10

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.57±0.23±0.01	10	² AUBERT, BE 06D	BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

¹ LEES 12F reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.27 \pm 0.09 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=A

² Superseded by LEES 12F. AUBERT, BE 06D reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.28 \pm 0.11 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=AU

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{52}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.346±0.129±0.004	12	¹ LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071G13
NODE=M071G13

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.346±0.168±0.004	6 ± 3	² AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ LEES 12F reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.17 \pm 0.06 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=A

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.17 \pm 0.08 \pm 0.02$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.1 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=AU

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{59}\Gamma_7/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.147±0.035±0.005	66	¹ LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
0.197±0.035±0.005	66	² LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
0.35 ±0.14 ±0.03	11	³ LEES	13Q BABR	$e^+e^- \rightarrow K^+K^-\gamma$

NODE=M071G06
NODE=M071G06

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.147±0.035±0.005	66	¹ LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
0.197±0.035±0.005	66	² LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
0.35 ±0.14 ±0.03	11	³ LEES	13Q BABR	$e^+e^- \rightarrow K^+K^-\gamma$

OCCUR=2

¹ $\sin\phi > 0$.

² $\sin\phi < 0$.

³ Interference with non-resonant K^+K^- production not taken into account.

NODE=M071G06;LINKAGE=A
NODE=M071G06;LINKAGE=B
NODE=M071G06;LINKAGE=BA

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{60} \Gamma_7 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
1.92±0.30±0.06	133	LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.56±0.42±0.16	85	¹ AUBERT	07AK BABR	10.6 e ⁺ e ⁻ → π ⁺ π ⁻ K ⁺ K ⁻ γ
¹ Superseded by LEES 12F.				

NODE=M071G12
NODE=M071G12

NODE=M071G12;LINKAGE=A

$$\Gamma(K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{64} \Gamma_7 / \Gamma$$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<0.7	90	8	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ γ

NODE=M071G15
NODE=M071G15

$$\Gamma(K^+ K^- \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{65} \Gamma_7 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.60±0.31±0.03	17	LEES	12F BABR	10.6 e ⁺ e ⁻ → π ⁰ π ⁰ K ⁺ K ⁻ γ

NODE=M071G08
NODE=M071G08

$$\Gamma(K^+ K^- \pi^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{66} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.54±0.63±0.15	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P47
NODE=M071P47

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{67} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
4.0±1.4±0.4	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P48
NODE=M071P48

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{68} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
5.1±0.7±0.4	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P49
NODE=M071P49

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{69} \Gamma_7 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
4.4±1.3±0.3	32	AUBERT	07AU BABR	10.6 e ⁺ e ⁻ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰ γ

NODE=M071G04
NODE=M071G04

$$\Gamma(K_S^0 K_L^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{76} \Gamma_7 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.92±1.27±0.15	14	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ π ⁰ π ⁰ γ

NODE=M071G14
NODE=M071G14

$$\Gamma(K_S^0 K^*(892)^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{77} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
0.71±0.29±0.07	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P54
NODE=M071P54

$$\Gamma(K_S^0 K^\pm \rho(770)^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{78} \Gamma_7 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P58
NODE=M071P58

$$\Gamma(K_S^0 K^\pm \pi^\mp \rho(770)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{79} \Gamma_7 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P59
NODE=M071P59

$$\Gamma(K^*(892)^+ K^*(892)^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{81} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
8.46±4.05±0.90	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P56
NODE=M071P56

$$\Gamma(K^\mp K^*(892)^\pm \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{80} \Gamma_7 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.62±0.66±0.15	LEES	23 BABR	e ⁺ e ⁻ → γ _{ISR} hadrons

NODE=M071P55
NODE=M071P55

$$\Gamma(K_S^0 K_L^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{82} \Gamma_7 / \Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.14±1.08±0.16	16	LEES	17A BABR	e ⁺ e ⁻ → K _S ⁰ K _L ⁰ ηγ

NODE=M071G16
NODE=M071G16

$$\Gamma(K^+ K^- \pi^+ \pi^- \eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{85}\Gamma/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.05±1.80±0.01	7	¹ AUBERT 07AU BABR	10.6	$e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \eta) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.2 \pm 0.7 \pm 0.1$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.36 \pm 0.18) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M071G05
NODE=M071G05

NODE=M071G05;LINKAGE=UB

$$\Gamma(K^+ K^- 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{86}\Gamma/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±2.1±0.3	26	AUBERT 06D BABR	10.6	$e^+ e^- \rightarrow K^+ K^- 2(\pi^+ \pi^-) \gamma$

NODE=M071G5
NODE=M071G5

$$\Gamma(2(K^+ K^-)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{89}\Gamma/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.22±0.10±0.02	13	LEES 12F BABR	10.6	$e^+ e^- \rightarrow K^+ K^- K^+ K^- \gamma$

NODE=M071G07
NODE=M071G07

$$\Gamma(p\bar{p}) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{111}\Gamma/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.686±0.024 OUR FIT	Error includes scale factor of 1.2.	[0.686 ± 0.019 eV OUR 2023 FIT]		

NODE=M071G2
NODE=M071G2
NEW

0.63 ±0.05 OUR AVERAGE	Error includes scale factor of 1.2.			
0.67 ±0.12 ±0.02	43	¹ LEES 130 BABR	$e^+ e^- \rightarrow p\bar{p}\gamma$	
0.74 ±0.07 ±0.04	142	² LEES 13Y BABR	$e^+ e^- \rightarrow p\bar{p}\gamma$	
0.579±0.038±0.036	2.7k	ANDREOTTI 07 E835	$p\bar{p} \rightarrow e^+ e^-, J/\psi X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.70 ±0.17 ±0.03	22	³ AUBERT 06B BABR	$e^+ e^- \rightarrow p\bar{p}\gamma$	
¹ ISR photon reconstructed in the detector				
² ISR photon undetected				
³ Superseded by LEES 130				

NODE=M071G2;LINKAGE=C
NODE=M071G2;LINKAGE=B
NODE=M071G2;LINKAGE=A

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{134}\Gamma/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
1.5±0.4±0.1	AUBERT 07BD BABR	10.6	$e^+ e^- \rightarrow \Lambda\bar{\Lambda}\gamma$

NODE=M071G11
NODE=M071G11

$\psi(2S)$ BRANCHING RATIOS

NODE=M071235

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.9785±0.0013 OUR AVERAGE			
0.9779±0.0015	¹ BAI 02B BES2	$e^+ e^-$	
0.981 ±0.003	¹ LUTH 75 MRK1	$e^+ e^-$	
¹ Includes cascade decay into $J/\psi(1S)$.			

NODE=M071R3
NODE=M071R3

NODE=M071R;LINKAGE=P

$$\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0179±0.0004 OUR AVERAGE	[0.0173 ± 0.0014 OUR 2023 AVERAGE Scale factor = 1.5]		
0.0179±0.0004	¹ LIAO 23 RVUE	$e^+ e^-$	
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.0166±0.0010	^{2,3} SETH 04 RVUE	$e^+ e^-$	
0.0199±0.0019	² BAI 02B BES2	$e^+ e^-$	
0.029 ±0.004	² LUTH 75 MRK1	$e^+ e^-$	

NODE=M071R5
NODE=M071R5
NEW

- ¹ Using $B(\psi(2S) \rightarrow \ell^+ \ell^-) = (0.794 \pm 0.017)\%$ and $R = 2.26 \pm 0.01$ determined by a fit to data from Mark-I, DM2, BESII, KEDR, and BESIII.
- ² Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.
- ³ Using $B(\psi(2S) \rightarrow \ell^+ \ell^-) = (0.73 \pm 0.04)\%$ from RPP-2002 and $R = 2.28 \pm 0.04$ determined by a fit to data from BAI 00 and BAI 02C. Superseded by LIAO 23.

NODE=M071R5;LINKAGE=A

NODE=M071R;LINKAGE=Z
NODE=M071R5;LINKAGE=SE

$$\Gamma(g g g)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
10.58±1.62	2.9 M	¹ LIBBY 09 CLEO	$\psi(2S) \rightarrow \text{hadrons}$	

NODE=M071S43
NODE=M071S43

- ¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09, $B(\psi(2S) \rightarrow X J/\psi)$ relative and absolute branching fractions from MENDEZ 08, $B(\psi(2S) \rightarrow \gamma \eta_c)$ from MITCHELL 09, and $B(\psi(2S) \rightarrow \text{virtual } \gamma \rightarrow \text{hadrons})$, $B(\psi(2S) \rightarrow \gamma \chi_{cJ})$, and $B(\psi(2S) \rightarrow \ell^+ \ell^-)$ from PDG 08. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(\gamma g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.

NODE=M071S43;LINKAGE=LI

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.025 ± 0.288	200 k	¹ LIBBY	09	CLEO $\psi(2S) \rightarrow \gamma + \text{hadrons}$

¹ Calculated using $\Gamma(\gamma g g)/\Gamma(g g g) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(g g g)/\Gamma_{\text{total}}$ LIBBY 09 measurement.

NODE=M071S44
NODE=M071S44

NODE=M071S44;LINKAGE=LI

 $\Gamma(\gamma g g)/\Gamma(g g g)$ Γ_4/Γ_3

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.7 ± 2.6 ± 1.6	2.9 M	LIBBY	09	CLEO $\psi(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M071S45
NODE=M071S45

 $\Gamma(\text{light hadrons})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.154 ± 0.015	¹ MENDEZ	08	CLEO $e^+ e^- \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.169 ± 0.026	² ADAM	05A	CLEO $e^+ e^- \rightarrow \psi(2S)$

¹ Uses $B(\psi(2S) \rightarrow J/\psi X)$ from MENDEZ 08 and other branching fractions from PDG 07.

² Uses $B(J/\psi X)$ from ADAM 05A, $B(\chi_{cJ} \gamma)$, $B(\eta_c \gamma)$ from ATHAR 04 and $B(\ell^+ \ell^-)$ from PDG 04. Superseded by MENDEZ 08.

NODE=M071S27
NODE=M071S27

NODE=M071S27;LINKAGE=ME
NODE=M071S27;LINKAGE=AD

 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
79.4 ± 2.2 OUR FIT	Error includes scale factor of 1.3. $[(79.3 \pm 1.7) \times 10^{-4}]$ OUR 2023 FIT]		

• • • We do not use the following data for averages, fits, limits, etc. • • •

88 ± 13	¹ FELDMAN	77	RVUE $e^+ e^-$

¹ From an overall fit assuming equal partial widths for $e^+ e^-$ and $\mu^+ \mu^-$. For a measurement of the ratio see the entry $\Gamma(\mu^+ \mu^-)/\Gamma(e^+ e^-)$ below. Includes LUTH 75, HILGER 75, BURMESTER 77.

NODE=M071R1
NODE=M071R1

NEW

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	DOCUMENT ID
80 ± 6 OUR FIT	

NODE=M071R2
NODE=M071R2

 $\Gamma(\mu^+ \mu^-)/\Gamma(e^+ e^-)$ Γ_8/Γ_7

VALUE	DOCUMENT ID	TECN	COMMENT
1.00 ± 0.08 OUR FIT			
[1.00 ± 0.08 OUR 2023 FIT]			

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.89 ± 0.16	BOYARSKI	75C	MRK1 $e^+ e^-$

NODE=M071R4
NODE=M071R4
NEW

 $\Gamma(\tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
31 ± 4 OUR FIT			
30.8 ± 2.1 ± 3.8	¹ ABLIKIM	06W	BES $e^+ e^- \rightarrow \psi(2S)$

¹ Computed using PDG 02 value of $B(\psi(2S) \rightarrow \text{hadrons}) = 0.9810 \pm 0.0030$ to estimate the total number of $\psi(2S)$ events.

NODE=M071R75
NODE=M071R75

NODE=M071R75;LINKAGE=AB

———— DECAYS INTO $J/\psi(1S)$ AND ANYTHING ————

NODE=M071305

 $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$

$$\Gamma_{10}/\Gamma = (\Gamma_{12} + \Gamma_{13} + \Gamma_{14} + 0.343\Gamma_{180} + 0.195\Gamma_{181})/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.615 ± 0.007 OUR FIT	Error includes scale factor of 1.3. [0.614 ± 0.006 OUR 2023 FIT]			

0.55 ± 0.07 OUR AVERAGE

0.51 ± 0.12	BRANDELIK	79C	DASP $e^+ e^- \rightarrow \mu^+ \mu^- X$
0.57 ± 0.08	ABRAMS	75B	MRK1 $e^+ e^- \rightarrow \mu^+ \mu^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.644 ± 0.006 ± 0.016	¹ ABLIKIM	21Z	BES3 $e^+ e^- \rightarrow \ell^+ \ell^- X$
0.6254 ± 0.0016 ± 0.0155	² MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+ \ell^- X$
0.5950 ± 0.0015 ± 0.0190	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ From a fit to the $e^+ e^- \rightarrow J/\psi X$ cross section between 3.645 and 3.891 GeV, with $\Gamma(ee)$ and Γ fixed to the PDG 20 values of the cross particle fit which are correlated to "OUR FIT" value for $B(\psi(2S) \rightarrow J/\psi X)$.

² Not independent from other measurements of MENDEZ 08.

NODE=M071R10
NODE=M071R10
NEW

NODE=M071R10;LINKAGE=A

NODE=M071R10;LINKAGE=ME

$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$ Γ_7/Γ_{10}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.291$\pm$0.035 OUR FIT				Error includes scale factor of 1.3. [(1.291 $\pm$ 0.026) $\times$ 10 ⁻² OUR 2023 FIT]
1.28 $\pm$0.04 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
1.22 $\pm$ 0.02 $\pm$ 0.05	5097 $\pm$ 73	¹ ANDREOTTI 05	E835	$p\bar{p} \rightarrow \psi(2S) \rightarrow e^+e^-$
1.28 $\pm$ 0.03 $\pm$ 0.02		¹ AMBROGIANI 00A	E835	$p\bar{p} \rightarrow \psi(2S)$
1.44 $\pm$ 0.08 $\pm$ 0.02		¹ ARMSTRONG 97	E760	$\bar{p}p \rightarrow \psi(2S)$

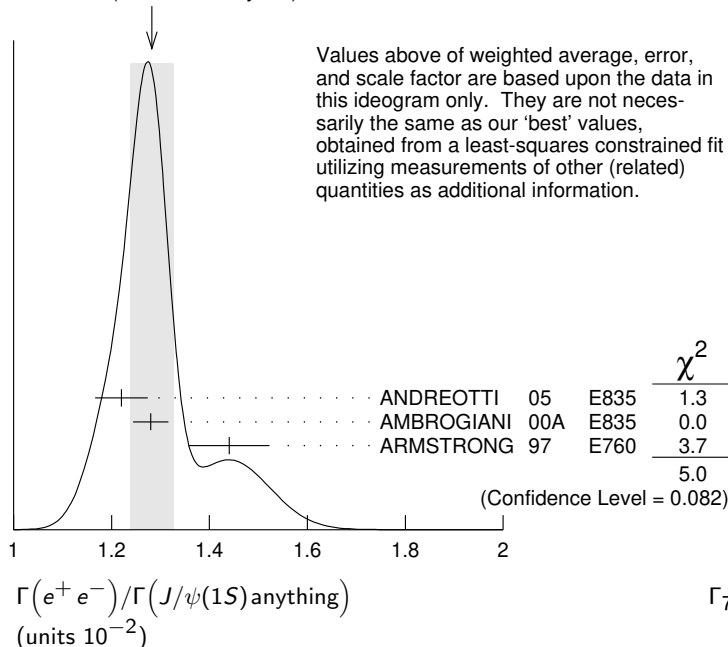
¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R72
NODE=M071R72

NEW

NODE=M071R;LINKAGE=7A

WEIGHTED AVERAGE
1.28 $\pm$ 0.04 (Error scaled by 1.6)

 $\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$ Γ_8/Γ_{10}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0130$\pm$0.0010 OUR FIT			
0.014 $\pm$0.003	HILGER	75	SPEC e^+e^-

NODE=M071R74
NODE=M071R74

 $\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID
0.254$\pm$0.005 OUR FIT	
	Error includes scale factor of 1.6. [0.2538 $\pm$ 0.0032 OUR 2023 FIT]

NODE=M071R18
NODE=M071R18
NEW

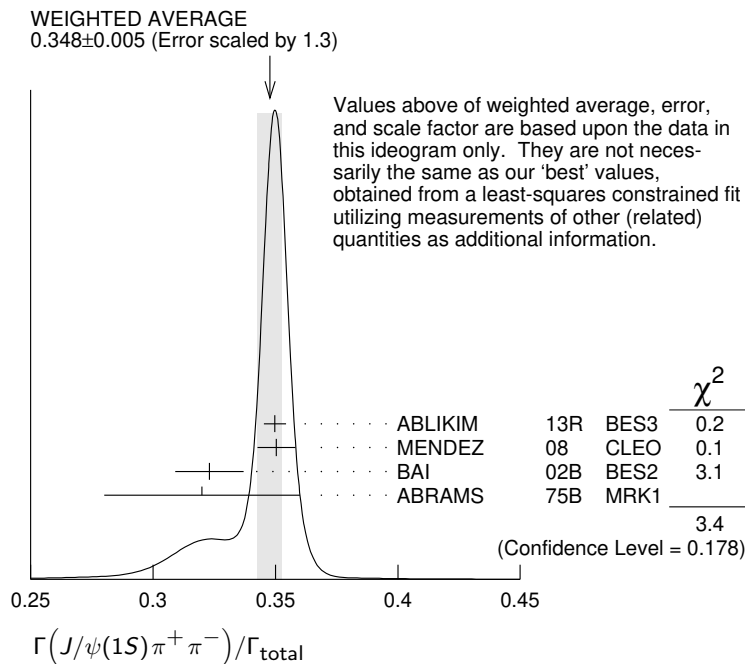
 $\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3469$\pm$0.0034 OUR FIT				Error includes scale factor of 1.1. [0.3468 $\pm$ 0.0030 OUR 2023 FIT]
0.348 $\pm$0.005 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
0.3498 $\pm$ 0.0002 $\pm$ 0.0045	20M	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$
0.3504 $\pm$ 0.0007 $\pm$ 0.0077	565k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$
0.323 $\pm$ 0.014		BAI	02B	BES2 e^+e^-
0.32 $\pm$ 0.04		ABRAMS	75B	MRK1 $e^+e^- \rightarrow J/\psi\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.3354 $\pm$ 0.0014 $\pm$ 0.0110	60k	¹ ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

NODE=M071R12
NODE=M071R12
NEW

NODE=M071R;LINKAGE=AD



$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_7/Γ_{12}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0006 OUR FIT	Error includes scale factor of 1.3. [0.0229 ± 0.0005 OUR 2023 FIT]		
0.0252±0.0028±0.0011	¹ AUBERT	02B	BABR e^+e^-
¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.			

NODE=M071R73
NODE=M071R73
NEW

NODE=M071R73;LINKAGE=7A

$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_8/Γ_{12}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0230±0.0017 OUR FIT			
0.0228±0.0018 OUR AVERAGE			
0.0230±0.0020±0.0012	¹ AAIJ	16Y	LHCB $\Lambda_b^0 \rightarrow \psi(2S)X$
0.0216±0.0026±0.0014	² AUBERT	02B	BABR e^+e^-
0.0327±0.0077±0.0072	² GRIBUSHIN	96	FMPS $515 \pi^- \text{Be} \rightarrow 2\mu X$
¹ Using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033) \times 10^{-2}$.			
² Using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = (5.88 \pm 0.10) \times 10^{-2}$.			

NODE=M071R63
NODE=M071R63

NODE=M071R63;LINKAGE=A
NODE=M071R;LINKAGE=Q2

$\Gamma(\tau^+\tau^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_9/Γ_{12}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8 ±1.1 OUR FIT			
8.73±1.39±1.57	BAI	02	BES e^+e^-

NODE=M071R76
NODE=M071R76

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma(J/\psi(1S)\text{anything})$

Γ_{12}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.564 ±0.004 OUR FIT	Error includes scale factor of 1.7. [0.5645 ± 0.0026 OUR 2023 FIT]			
0.554 ±0.008 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
0.5604±0.0009±0.0062	565k	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\pi^+\pi^-$
0.525 ±0.009 ±0.022	4k	ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$
0.536 ±0.007 ±0.016	20k	^{1,2} ABLIKIM	04B	BES $\psi(2S) \rightarrow J/\psi X$
0.496 ±0.037		ARMSTRONG	97	E760 $\bar{p}p \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.5637±0.0027±0.0046	60k	ADAM	05A	CLEO Repl. by MENDEZ 08

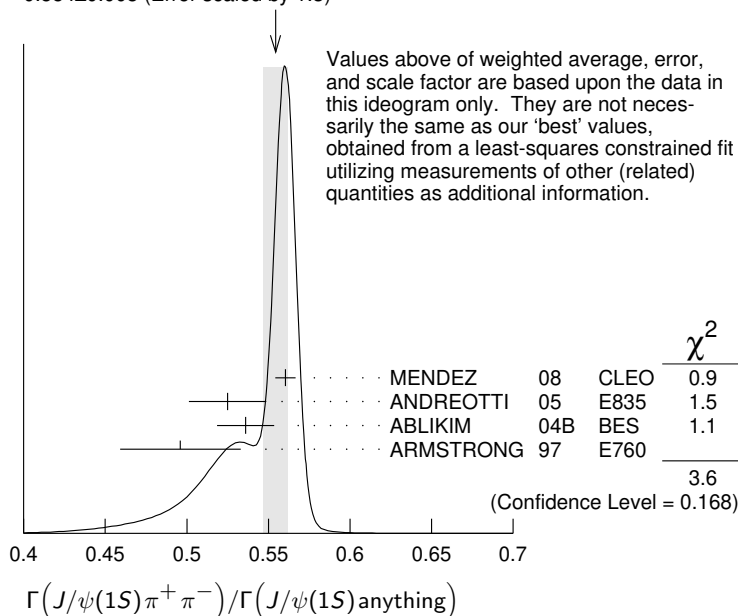
NODE=M071R70
NODE=M071R70
NEW

¹ From a fit to the J/ψ recoil mass spectra.

² ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi \pi^+\pi^-)$.

NODE=M071R;LINKAGE=AB
NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$

$$\Gamma_{11}/\Gamma_{12} = (0.9761\Gamma_{13} + 0.719\Gamma_{14} + 0.343\Gamma_{180} + 0.195\Gamma_{181})/\Gamma_{12}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.732±0.013 OUR FIT	Error includes scale factor of 1.7.	[0.732 ± 0.008 OUR 2023 FIT]	

NODE=M071R11
NODE=M071R11
NEW

0.73 ±0.09 TANENBAUM 76 MRK1 e^+e^-

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

Γ_{13}/Γ_{10}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.297 ±0.005 OUR FIT	Error includes scale factor of 1.7.	[0.2968 ± 0.0031 OUR 2023 FIT]		

NODE=M071R69
NODE=M071R69
NEW

0.320 ±0.012 OUR AVERAGE

0.300 ±0.008 ±0.022	1655 ± 44	ANDREOTTI	05 E835	$\psi(2S) \rightarrow J/\psi X$
0.328 ±0.013 ±0.008		AMBROGIANI	00A E835	$p\bar{p} \rightarrow \psi(2S)$
0.323 ±0.033		ARMSTRONG	97 E760	$\bar{p}p \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.2829±0.0012±0.0056	61k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \ell^+\ell^- 2\pi^0$
0.2776±0.0025±0.0043	13.4k	ADAM	05A CLEO	Repl. by MENDEZ 08

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{13}/Γ_{12}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.526 ±0.013 OUR FIT	Error includes scale factor of 1.7.	[0.526 ± 0.008 OUR 2023 FIT]		

NODE=M071R14
NODE=M071R14
NEW

0.513 ±0.022 OUR AVERAGE Error includes scale factor of 2.2.

0.5047±0.0022±0.0102	61k	MENDEZ	08 CLEO	$\psi(2S) \rightarrow \ell^+\ell^- 2\pi^0$
0.570 ±0.009 ±0.026	14k	¹ ABLIKIM	04B BES	$\psi(2S) \rightarrow J/\psi X$
0.4924±0.0047±0.0086	73k	^{2,3} ADAM	05A CLEO	Repl. by MENDEZ 08
0.571 ±0.018 ±0.044		⁴ ANDREOTTI	05 E835	$\psi(2S) \rightarrow J/\psi X$
0.53 ±0.06		TANENBAUM	76 MRK1	e^+e^-
0.64 ±0.15		⁵ HILGER	75 SPEC	e^+e^-

¹ From a fit to the J/ψ recoil mass spectra.

² Not independent from other values reported by ADAM 05A.

³ Using 13,217 $J/\psi\pi^0\pi^0$ and 60,010 $J/\psi\pi^+\pi^-$ events.

⁴ Not independent from other values reported by ANDREOTTI 05.

⁵ Ignoring the $J/\psi(1S)\eta$ and $J/\psi(1S)\gamma\gamma$ decays.

NODE=M071R14;LINKAGE=AB
NODE=M071R14;LINKAGE=AD
NODE=M071R14;LINKAGE=AM
NODE=M071R;LINKAGE=AN
NODE=M071R;LINKAGE=I

$\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT

33.7 ± 0.6 OUR FIT Error includes scale factor of 1.2. $[(33.7 \pm 0.5) \times 10^{-3}$ OUR 2023 FIT]

32.9 ± 1.7 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

33.75 ± 0.17 ± 0.86	68.2k	ABLIKIM	12M	BES3 $e^+e^- \rightarrow \ell^+\ell^-2\gamma$
29.8 ± 0.9 ± 2.3	5.7k	BAI	04I	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
25.5 ± 2.9	386	¹ OREGLIA	80	CBAL $e^+e^- \rightarrow J/\psi2\gamma$
45 ± 12	17	² BRANDELIK	79B	DASP $e^+e^- \rightarrow J/\psi2\gamma$
42 ± 6	164	² BARTEL	78B	CNTR e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

34.3 ± 0.4 ± 0.9	18.4k	³ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
32.5 ± 0.6 ± 1.1	2.8k	⁴ ADAM	05A	CLEO Repl. by MENDEZ 08
43 ± 8	44	TANENBAUM	76	MRK1 e^+e^-

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

³ Not independent from other measurements of MENDEZ 08.

⁴ Not independent from other values reported by ADAM 05A.

NODE=M071R15

NODE=M071R15

NEW

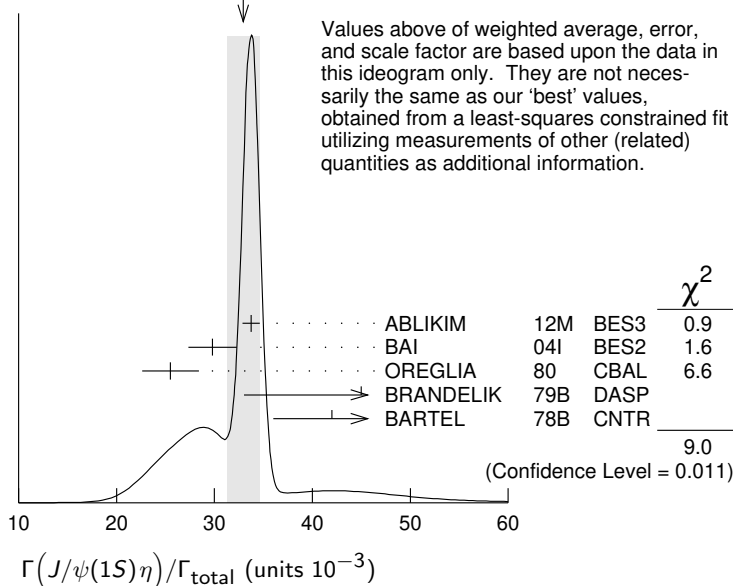
NODE=M071R;LINKAGE=3Q

NODE=M071R;LINKAGE=2Q

NODE=M071R15;LINKAGE=ME

NODE=M071R15;LINKAGE=AD

WEIGHTED AVERAGE
32.9±1.7 (Error scaled by 2.1)

 $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\text{anything})$ Γ_{14}/Γ_{10}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.0549 ± 0.0009 OUR FIT Error includes scale factor of 1.2. $[0.0549 \pm 0.0008$ OUR 2023 FIT]

0.058 ± 0.007 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

0.050 ± 0.006 ± 0.003	298 ± 20	ANDREOTTI	05	E835 $\psi(2S) \rightarrow J/\psi X$
0.072 ± 0.009		AMBROGIANI	00A	E835 $p\bar{p} \rightarrow \psi(2S)$
0.061 ± 0.015		ARMSTRONG	97	E760 $p\bar{p} \rightarrow \psi(2S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0549 ± 0.0006 ± 0.0009	18.4k	¹ MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$
0.0546 ± 0.0010 ± 0.0007	2.8k	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

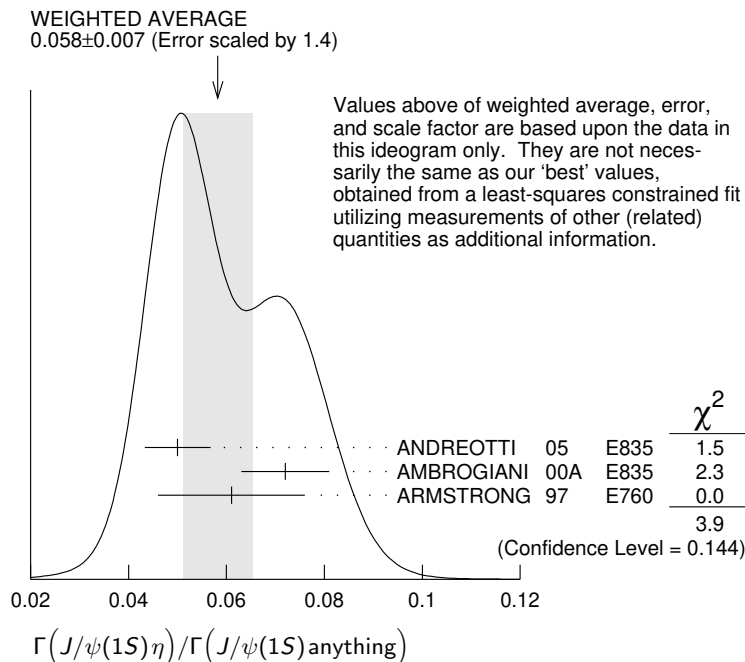
NODE=M071R68

NODE=M071R68

NEW

OCCUR=2

NODE=M071R68;LINKAGE=ME



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{14}/Γ_{12}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0972±0.0016 OUR FIT				Error includes scale factor of 1.1. [0.0972 ± 0.0014 OUR 2023 FIT]

0.0979±0.0018 OUR AVERAGE

0.0979±0.0010±0.0015	18.4k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-\eta$
0.098 ±0.005 ±0.010	2k	1 ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
0.091 ±0.021		2 HIMEL	80	MRK2	$e^+e^- \rightarrow \psi(2S)X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0968±0.0019±0.0013	2.8k	3 ADAM	05A	CLEO	Repl. by MENDEZ 08
0.095 ±0.007 ±0.007		4 ANDREOTTI	05	E835	$\psi(2S) \rightarrow J/\psi X$

¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow J/\psi(1S)\eta)$ reported in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (0.1181 \pm 0.0020)$.

³ Not independent from other values reported by ADAM 05A.

⁴ Not independent from other values reported by ANDREOTTI 05.

NODE=M071R71
NODE=M071R71
NEW

NODE=M071R71;LINKAGE=AB
NODE=M071R;LINKAGE=8H

NODE=M071R71;LINKAGE=AD
NODE=M071R71;LINKAGE=AN

$\Gamma(J/\psi(1S)\pi^0)/\Gamma_{\text{total}}$

Γ_{15}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
12.68±0.32 OUR AVERAGE				
12.6 ±0.2 ±0.3	4.1k	ABLIKIM	12M	BES3 $e^+e^- \rightarrow \ell^+\ell^- 2\gamma$
13.3 ±0.8 ±0.3	530	MENDEZ	08	CLEO $\psi(2S) \rightarrow \ell^+\ell^- 2\gamma$
14.3 ±1.4 ±1.2	280	BAI	04i	BES2 $\psi(2S) \rightarrow J/\psi\gamma\gamma$
14 ±6	7	HIMEL	80	MRK2 e^+e^-
9 ±2 ±1	23	¹ OREGLIA	80	CBAL $\psi(2S) \rightarrow J/\psi 2\gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
13 ±1 ±1	88	ADAM	05A	CLEO Repl. by MENDEZ 08

¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M071R16
NODE=M071R16

NODE=M071R16;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_{15}/\Gamma_{10} = \Gamma_{15}/(\Gamma_{12} + \Gamma_{13} + \Gamma_{14} + 0.343\Gamma_{180} + 0.195\Gamma_{181})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.213±0.012±0.003	527	1 MENDEZ	08	CLEO $e^+e^- \rightarrow J/\psi\gamma\gamma$
0.22 ±0.02 ±0.01		2 ADAM	05A	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S25
NODE=M071S25

NODE=M071S25;LINKAGE=ME
NODE=M071S25;LINKAGE=AD

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{15}/Γ_{12}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.380 \pm 0.022 \pm 0.005$	527	¹ MENDEZ	08	CLEO	$e^+e^- \rightarrow J/\psi\gamma\gamma$
$0.39 \pm 0.04 \pm 0.01$		² ADAM	05A	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow J/\psi\gamma\gamma$

¹ Not independent from other values reported by MENDEZ 08. Supersedes ADAM 05A.

² Not independent from other values reported by ADAM 05A.

NODE=M071S26
NODE=M071S26

NODE=M071S26;LINKAGE=ME
NODE=M071S26;LINKAGE=AD

NODE=M071310

HADRONIC DECAYS

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.78 ± 0.26 OUR AVERAGE

$0.76 \pm 0.25 \pm 0.06$		30	¹ METREVELI	12	$\psi(2S) \rightarrow \pi^+\pi^-$
8 ± 5			BRANDELIK	79C	DASP e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.1	90	DOBBS	06A	CLEO	$e^+e^- \rightarrow \psi(2S)$
< 5	90	FELDMAN	77	MRK1	e^+e^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. Using $\psi(3770) \rightarrow \pi^+\pi^-$ for continuum subtraction.

NODE=M071R20
NODE=M071R20

NODE=M071R20;LINKAGE=ME

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

2.01 ± 0.17 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.

$2.14 \pm 0.03^{+0.12}_{-0.11}$	7k	¹ ABLIKIM	12H	BES3	$e^+e^- \rightarrow \psi(2S)$
$1.81 \pm 0.18 \pm 0.19$	260 ± 19	² ABLIKIM	05J	BES2	$e^+e^- \rightarrow \psi(2S)$
$1.88^{+0.16}_{-0.15} \pm 0.28$	194	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$
0.85 ± 0.46	4	FRANKLIN	83	MRK2	$e^+e^- \rightarrow \text{hadrons}$

¹ From $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$ events directly. The quoted systematic error includes a contribution of 4% (added in quadrature) from the uncertainty on the number of $\psi(2S)$ events.

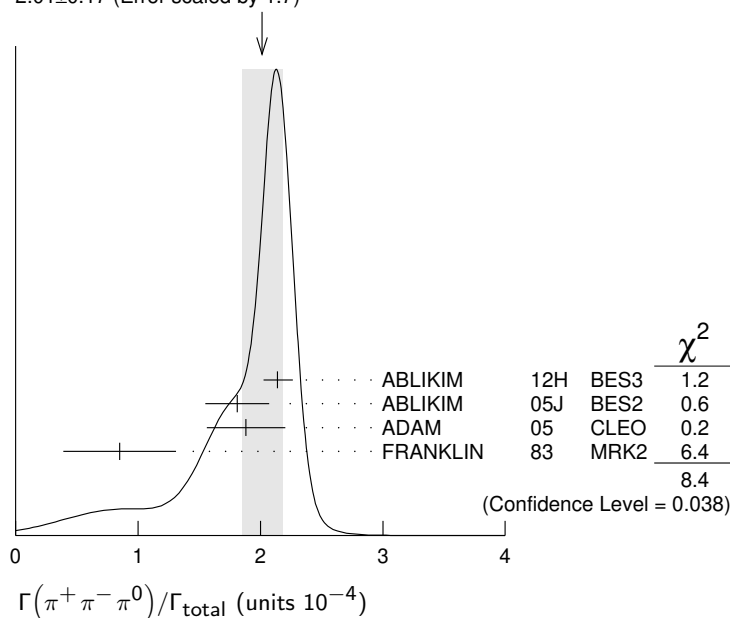
² From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R36
NODE=M071R36

NODE=M071R36;LINKAGE=AB

NODE=M071R;LINKAGE=AK

WEIGHTED AVERAGE
 2.01 ± 0.17 (Error scaled by 1.7)

 $\Gamma(\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.32 ± 0.12 OUR AVERAGE Error includes scale factor of 1.8.

$0.51 \pm 0.07 \pm 0.11$		¹ ABLIKIM	05J	BES2	$\psi(2S) \rightarrow \rho(770)\pi \rightarrow \pi^+\pi^-\pi^0$
$0.24^{+0.08}_{-0.07} \pm 0.02$	22	ADAM	05	CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R26
NODE=M071R26

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.83	90	1	FRANKLIN	83	MRK2	e^+e^-
<10	90		BARTEL	76	CNTR	e^+e^-
<10	90	2	ABRAMS	75	MRK1	e^+e^-

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

² Final state $\rho^0\pi^0$.

NODE=M071R26;LINKAGE=AK
NODE=M071R;LINKAGE=N

$\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.94 \pm 0.25^{+1.15}_{-0.34}$	¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$

NODE=M071R57
NODE=M071R57

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R57;LINKAGE=AK

$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 ± 0.6 OUR AVERAGE				Error includes scale factor of 2.2.
$2.2 \pm 0.2 \pm 0.2$	308	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.5 ± 1.0		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R27
NODE=M071R27

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.6 OUR AVERAGE				Error includes scale factor of 1.4.
$2.0 \pm 0.2 \pm 0.4$	285.5	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)$
4.2 ± 1.5		TANENBAUM	78 MRK1	e^+e^-

NODE=M071R33
NODE=M071R33

$\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
29 ± 10 OUR AVERAGE				Error includes scale factor of 4.7. See the ideogram below.
$[(29 \pm 10) \times 10^{-4}]$				OUR 2023 AVERAGE Scale factor = 4.7]
$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
$127 \pm 12 \pm 2$	410	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$
$26.1 \pm 0.7 \pm 3.0$	1703	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
30 ± 8	42	FRANKLIN	83 MRK2	e^+e^-

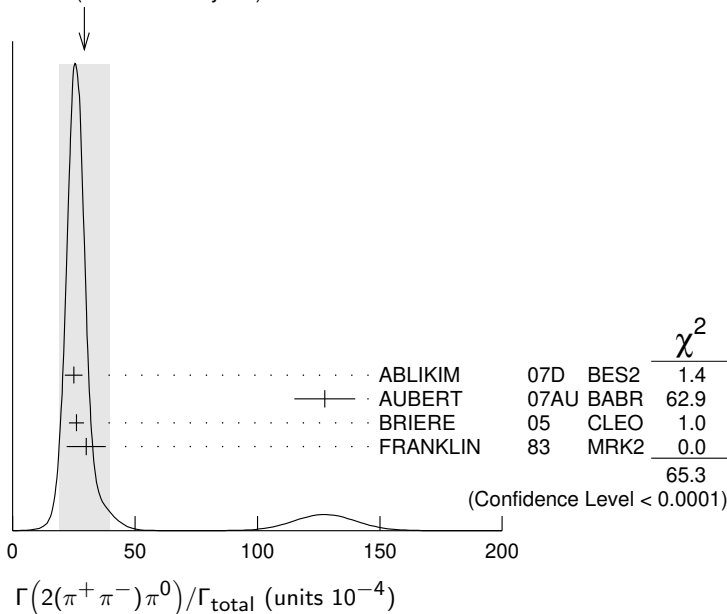
NODE=M071R22
NODE=M071R22

NEW

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (297 \pm 22 \pm 18) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R22;LINKAGE=UB

WEIGHTED AVERAGE
 29 ± 10 (Error scaled by 4.7)



$\Gamma(\rho a_2(1320))/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$2.55 \pm 0.73 \pm 0.47$		112 ± 31	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.3		90	BAI	98J BES	$e^+ e^-$

NODE=M071R65
 NODE=M071R65

 $\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{27}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3.5 $\pm$ 2.0 OUR AVERAGE		Error includes scale factor of 2.8.		
5.45 $\pm$ 0.42 $\pm$ 0.87	671	ABLIKIM	05H BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow$ $3(\pi^+ \pi^-)$
1.5 $\pm$ 1.0		¹ TANENBAUM	78 MRK1	$e^+ e^-$

NODE=M071R32
 NODE=M071R32

¹ Assuming entirely strong decay.

NODE=M071R32;LINKAGE=K

 $\Gamma(3(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
35 ± 16	6	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R37
 NODE=M071R37

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

NODE=M071S06
 NODE=M071S06

 $\Gamma(\eta \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
9.5±0.7±1.5		¹ BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10.3±0.8±1.4	201.7	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$
8.1±1.4±1.6	50.0	² BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

NODE=M071S07
 NODE=M071S07

OCCUR=2

OCCUR=3

¹ Average of $\eta \rightarrow \gamma \gamma$ and $\eta \rightarrow 3\pi$.

² Not independent from other values reported by BRIERE 05.

NODE=M071S07;LINKAGE=BR
 NODE=M071S07;LINKAGE=BI

 $\Gamma(\rho \eta)/\Gamma_{\text{total}}$ Γ_{37}/Γ

<u>VALUE (units 10^{-5})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2.2 $\pm$ 0.6 OUR AVERAGE		Error includes scale factor of 1.1.			
3.0 $\begin{smallmatrix} +1.1 \\ -0.9 \end{smallmatrix} \pm 0.2$	18	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$	
1.78 $\begin{smallmatrix} +0.67 \\ -0.62 \end{smallmatrix} \pm 0.17$	13	ABLIKIM	04L BES	$e^+ e^- \rightarrow \psi(2S)$	

NODE=M071R94
 NODE=M071R94

 $\Gamma(\eta' \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.6 \pm 1.3$	12.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$

NODE=M071S08
 NODE=M071S08

 $\Gamma(\eta' \rho)/\Gamma_{\text{total}}$ Γ_{39}/Γ

<i>VALUE</i> (units 10^{-5})	<i>EVTs</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
1.87 $\stackrel{+1.64}{-1.11}$ ± 0.33	2	ABLIKIM	04L BES	$e^+ e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.02 ± 0.11 ± 0.24	143	¹ ABLIKIM	17AK BES3	$e^+ e^- \rightarrow \psi(2S)$
0.569 $\pm 0.128 \pm 0.236$	80	² ABLIKIM	17AK BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R93
 NODE=M071R93

OCCUR=2

¹ Destructive-interference solution of a partial wave analysis of the decay $\psi(2S) \rightarrow \pi^+ \pi^- \eta'$.

² Constructive-interference solution of a partial wave analysis of the decay $\psi(2S) \rightarrow \pi^+ \pi^- \eta'$.

NODE=M071R93;LINKAGE=A

NODE=M071R93;LINKAGE=B

 $\Gamma(\omega \pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

<u>VALUE (units 10^{-5})</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2.1 $\pm$ 0.6 OUR AVERAGE				
2.5 $^{+1.2}_{-1.0}$ $\pm$ 0.2	14	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
1.87 $^{+0.68}_{-0.62}$ $\pm$ 0.28	14	ABLIKIM	04L BES	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R92
 NODE=M071R92

$\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{41}/Γ

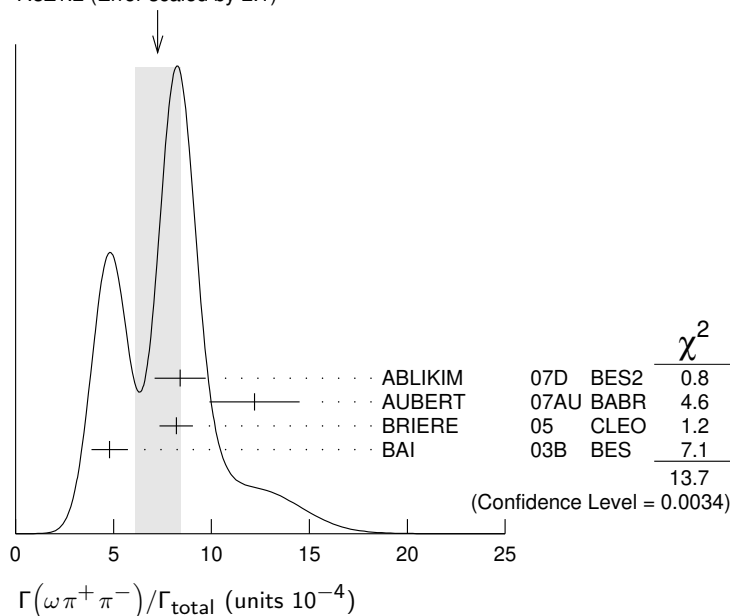
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±1.2 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
8.4±0.5±1.2	386	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
12.2±2.2±0.7	37	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
8.2±0.5±0.7	391	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
4.8±0.6±0.7	100 ± 22	² BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16$ eV.				
² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

NODE=M071R77
 NODE=M071R77

NODE=M071R77;LINKAGE=UB

NODE=M071R77;LINKAGE=B3

WEIGHTED AVERAGE
 7.3±1.2 (Error scaled by 2.1)

 $\Gamma(b_1^\pm\pi^\mp)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ±0.6 OUR AVERAGE		Error includes scale factor of 1.1.		
5.1 ±0.6 ±0.8	202	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
4.18 ^{+0.43} _{-0.42} ±0.92	170	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
3.2 ±0.6 ±0.5	61 ± 11	^{1,2} BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.2 ±0.8 ±1.0		¹ BAI	99C BES	Repl. by BAI 03B
¹ Assuming $B(b_1 \rightarrow \omega\pi)=1$.				
² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.				

NODE=M071R40
 NODE=M071R40

NODE=M071R;LINKAGE=M1
 NODE=M071R40;LINKAGE=B3

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ±0.4 OUR AVERAGE					
2.3 ±0.5 ±0.4		57	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$
2.05±0.41±0.38		62 ± 12	BAI	04C BES2	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.5	90		¹ BAI	03B BES	$\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
<1.7	90		BAI	98J BES	Repl. by BAI 03B
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.					

NODE=M071R64
 NODE=M071R64

NODE=M071R64;LINKAGE=B3

 $\Gamma(b_1^0\pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35^{+0.47}_{-0.42} ±0.40	45	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R21
 NODE=M071R21

$\Gamma(\omega\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<3.1	90	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

 Γ_{48}/Γ

 NODE=M071R95
 NODE=M071R95

$\Gamma(\omega\eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.2^{+2.4}_{-2.0} \pm 0.7$	4	¹ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

 Γ_{49}/Γ

 NODE=M071R91
 NODE=M071R91

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R91;LINKAGE=AI

$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
<0.4	90	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

 Γ_{50}/Γ

 NODE=M071R96
 NODE=M071R96

$\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.18 ± 0.26 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
$2.3 \pm 0.8 \pm 0.1$	19 ± 6	LEES	12F BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^- K^+ K^- \gamma$
$0.9 \pm 0.2 \pm 0.1$	47.6	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
$1.5 \pm 0.2 \pm 0.2$	51.5 ± 8.3	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.45 \pm 0.96 \pm 0.04$	10 ± 4	^{2,3} AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^- K^+ K^- \gamma$

 Γ_{51}/Γ

 NODE=M071R80
 NODE=M071R80

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

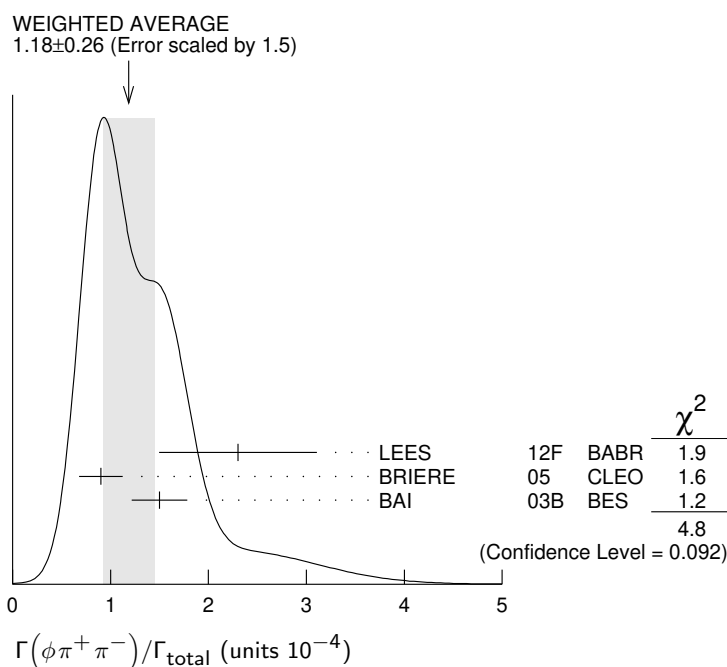
NODE=M071R80;LINKAGE=B3

² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (0.57 \pm 0.22 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R80;LINKAGE=BE

³ Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R80;LINKAGE=UB



$\Gamma(\phi f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75$\pm$0.33 OUR AVERAGE	Error	includes scale factor of 1.6.		
1.5 $\pm$ 0.5 $\pm$ 0.1	12 $\pm$ 4	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
0.6 $\pm$ 0.2 $\pm$ 0.1	18.4 $\pm$ 6.4	¹ BAI	03B BES	$\psi(2S) \rightarrow K^+K^-\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.46 $\pm$ 0.71 $\pm$ 0.02	6 $\pm$ 3	^{2,3} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi f_0(980) \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (0.34 \pm 0.16 \pm 0.04) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.³ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.NODE=M071R83
NODE=M071R83NODE=M071R83;LINKAGE=B3
NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB

 $\Gamma(\phi \eta)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10$\pm$0.31 OUR AVERAGE				
3.14 $\pm$ 0.23 $\pm$ 0.23	0.2k	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$
2.0 $\pm$ 1.5 $\pm$ 0.4	6	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
3.3 $\pm$ 1.1 $\pm$ 0.5	17	ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R89
NODE=M071R89 $\Gamma(\eta \phi(2170), \phi(2170) \rightarrow \phi f_0(980), f_0 \rightarrow \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 $\times 10^{-6}$	90	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta \phi f_0(980)$

NODE=M071P19
NODE=M071P19 $\Gamma(\phi \eta')/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.54$\pm$0.20 OUR AVERAGE				
1.51 $\pm$ 0.16 $\pm$ 0.12	201	ABLIKIM	19BA BES3	$e^+e^- \rightarrow \psi(2S)$
3.1 $\pm$ 1.4 $\pm$ 0.7	8	¹ ABLIKIM	04K BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R90
NODE=M071R90¹ Calculated combining $\eta' \rightarrow \gamma \rho$ and $\eta \pi^+ \pi^-$ channels.

NODE=M071R;LINKAGE=AI

 $\Gamma(\phi f_1(1285))/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0$\pm$0.4$\pm$1.3	234	¹ ABLIKIM	19BA BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P22
NODE=M071P22¹ ABLIKIM 19BA reports $[\Gamma(\psi(2S) \rightarrow \phi f_1(1285))/\Gamma_{\text{total}}] \times [B(f_1(1285) \rightarrow \eta \pi^+ \pi^-)] = (1.03 \pm 0.10 \pm 0.09) \times 10^{-5}$ which we divide by our best value $B(f_1(1285) \rightarrow \eta \pi^+ \pi^-) = (35 \pm 15) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P22;LINKAGE=B

 $\Gamma(\phi \eta(1405) \rightarrow \phi \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
8.46$\pm$1.37$\pm$0.92	195	ABLIKIM	19BA BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P24
NODE=M071P24 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.44$\pm$0.12$\pm$0.11	20 $\pm$ 6	BAI	04C		$\psi(2S) \rightarrow 2(K^+ K^-)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.45	90	BAI	98J BES		$e^+e^- \rightarrow 2(K^+ K^-)$

NODE=M071R67
NODE=M071R67 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.48$\pm$0.23$\pm$0.39	1.3k	¹ METREVELI	12		$\psi(2S) \rightarrow K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.2 $\pm$ 1.5 $\pm$ 0.2	66	^{2,3} LEES	15J BABR		$e^+e^- \rightarrow K^+ K^- \gamma$
8.3 $\pm$ 1.5 $\pm$ 0.2	66	^{3,4} LEES	15J BABR		$e^+e^- \rightarrow K^+ K^- \gamma$
6.3 $\pm$ 0.6 $\pm$ 0.3		⁵ DOBBS	06A CLEO		e^+e^-
10 $\pm$ 7		⁵ BRANDELIK	79C DASP		e^+e^-
< 5	90	FELDMAN	77 MRK1		e^+e^-

NODE=M071R23
NODE=M071R23

OCCUR=2

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.² $\sin \phi > 0$.³ Using $\Gamma(\psi(2S) \rightarrow e^+ e^-) = (2.37 \pm 0.04)$ keV.⁴ $\sin \phi < 0$.⁵ Interference with non-resonant $K^+ K^-$ production not taken into account.NODE=M071R23;LINKAGE=ME
NODE=M071R23;LINKAGE=A
NODE=M071R23;LINKAGE=B
NODE=M071R23;LINKAGE=C
NODE=M071R23;LINKAGE=BA

$\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3±0.5 OUR AVERAGE				
8.1±1.3±0.3	133	LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
7.1±0.3±0.4	817.2	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
16 ±4		¹ TANENBAUM	78 MRK1	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11.0±1.9±0.2	85	² AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

¹ Assuming entirely strong decay.

² Superseded by LEES 12F. AUBERT 07AK reports [$\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$] $\times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (2.56 \pm 0.42 \pm 0.16) \times 10^{-3}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R24
NODE=M071R24

NODE=M071R24;LINKAGE=K
NODE=M071R24;LINKAGE=BE

 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
4.07±0.16±0.26		0.9k	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.9	90	1	FRANKLIN	83 MRK2	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R38
NODE=M071R38

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
<0.046	¹ BAI	04D BES	$e^+ e^-$

¹ Forbidden by CP.

NODE=M071R88
NODE=M071R88

NODE=M071R;LINKAGE=BA

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.34±0.33 OUR AVERAGE				
5.28±0.25±0.34	478 ± 23	¹ METREVELI	12	$\psi(2S) \rightarrow K_S^0 K_L^0$
5.8 ±0.8 ±0.4		DOBBS	06A CLEO	$e^+ e^-$
5.24±0.47±0.48	156 ± 14	² BAI	04B BES2	$\psi(2S) \rightarrow K_S^0 K_L^0 \rightarrow \pi^+ \pi^- X$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.² Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6860 \pm 0.0027$.

NODE=M071R87
NODE=M071R87

NODE=M071R87;LINKAGE=ME
NODE=M071R;LINKAGE=KZ

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±0.9 OUR AVERAGE				
18.9±5.7±0.3	32	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0 \gamma$
11.7±1.0±1.5	597	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
12.7±0.5±1.0	711.6	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

¹ AUBERT 07AU reports [$\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$] $\times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (44 \pm 13 \pm 3) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071S10
NODE=M071S10

NODE=M071S10;LINKAGE=UB

 $\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.9	19	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S20
NODE=M071S20

 $\Gamma(K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±1.3±1.8	238	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S21
NODE=M071S21

 $\Gamma(K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±2.2±1.7	133	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S22
NODE=M071S22

$\Gamma(K^*(892)^+ K^- \rho^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{73}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3 \pm 2.2 \pm 1.4$	78	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S23
NODE=M071S23

 $\Gamma(K^*(892)^0 K^- \rho^+ + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{74}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1 \pm 1.3 \pm 1.2$	125	ABLIKIM	06G BES2	$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S24
NODE=M071S24

 $\Gamma(K_S^0 K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{75}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.20 \pm 0.25 \pm 0.37$	83 ± 9	ABLIKIM	05o BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R49
NODE=M071R49

 $\Gamma(K^+ K^- \rho^0)/\Gamma_{\text{total}}$
 Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.2 \pm 0.2 \pm 0.4$	223.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M071S09
NODE=M071S09

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$
 Γ_{84}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.86 \pm 0.32 \pm 0.43$	93 ± 16	BAI	04C		$\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90	BAI	98J BES		$e^+ e^-$

NODE=M071R66
NODE=M071R66

 $\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$
 Γ_{85}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.3 \pm 0.7 \pm 0.1$	7	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma \gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.				

NODE=M071S39
NODE=M071S39

NODE=M071S39;LINKAGE=UB

 $\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{87}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$10.0 \pm 2.5 \pm 1.8$	65	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071R09
NODE=M071R09

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{88}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2.			
$3.18 \pm 0.30^{+0.26}_{-0.31}$		0.2k	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$
$2.9^{+1.3}_{-1.7} \pm 0.4$	9.6 ± 4.2		ABLIKIM	05i BES2	$e^+ e^- \rightarrow \psi(2S)$
$1.3^{+1.0}_{-0.7} \pm 0.3$	7		ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<5.4	90	FRANKLIN	83 MRK2		$e^+ e^- \rightarrow \text{hadrons}$

NODE=M071R39
NODE=M071R39

 $\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$
 Γ_{89}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.63 ± 0.13 OUR AVERAGE				
$0.9 \pm 0.4 \pm 0.1$	13	LEES	12F BABR	$10.6 e^+ e^- \rightarrow 2(K^+ K^-) \gamma$
$0.6 \pm 0.1 \pm 0.1$	59.2	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$

NODE=M071S12
NODE=M071S12

 $\Gamma(2(K^+ K^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{90}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.2 \pm 0.2$	44.7	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-) \pi^0$

NODE=M071S13
NODE=M071S13

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$
 Γ_{91}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70 ± 0.16 OUR AVERAGE				
$0.8 \pm 0.2 \pm 0.1$	36.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(K^+ K^-)$
$0.6 \pm 0.2 \pm 0.1$	16.1 ± 5.0	¹ BAI	03B BES	$\psi(2S) \rightarrow 2(K^+ K^-)$
¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.				

NODE=M071R81
NODE=M071R81

NODE=M071R81;LINKAGE=B3

$\Gamma(K_S^0 K_S^0 \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.353 \pm 0.020 \pm 0.021$	687	¹ ABLIKIM	23BA BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K_S^0 K_S^0 K^+ K^-$

 Γ_{92}/Γ

NODE=M071P53
NODE=M071P53

¹ Solution with a constructive interference of the signal with the continuum background.

NODE=M071P53;LINKAGE=A

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$10.0 \pm 1.8 \pm 2.1$	¹ BAI	99C BES	$e^+ e^-$

 Γ_{93}/Γ

NODE=M071R41
NODE=M071R41

¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$

NODE=M071R;LINKAGE=M2

 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
6.7 ± 2.5	TANENBAUM 78	MRK1	$e^+ e^-$

 Γ_{94}/Γ

NODE=M071R34
NODE=M071R34

 $\Gamma(\eta K^+ K^-, \text{ no } \eta \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$3.49 \pm 0.09 \pm 0.15$	1.8k		¹ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \gamma \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.08 \pm 0.29 \pm 0.25$	0.3k		^{1,2} ABLIKIM	12L BES3	$\psi(2S) \rightarrow K^+ K^- \gamma \gamma$
<13	90		BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{95}/Γ

NODE=M071S11
NODE=M071S11

¹ Excluding $\eta \phi$.

² Superseded by ABLIKIM 20F.

NODE=M071S11;LINKAGE=AB
NODE=M071S11;LINKAGE=A

 $\Gamma(\eta K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	¹ LEES	23 BABR	$e^+ e^- \rightarrow \gamma_{ISR} \text{ hadrons}$

 $\Gamma_{96}\Gamma_7/\Gamma$

NODE=M071P57
NODE=M071P57

¹ LEES 23 reports $[\Gamma(\psi(2S) \rightarrow \eta K^+ K^-) \times \Gamma(\psi(2S) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 3\pi^0)] < 0.2 \text{ eV}$ which we divide by our best value $B(\eta \rightarrow 3\pi^0) = 32.57 \times 10^{-2}$.

NODE=M071P57;LINKAGE=A

 $\Gamma(X(1750)\eta \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
$4.8 \pm 1.0 \pm 2.6$	ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$

 Γ_{97}/Γ

NODE=M071P28
NODE=M071P28

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	¹ BAI	99C BES	$e^+ e^-$

 Γ_{98}/Γ

NODE=M071R45
NODE=M071R45

¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$

NODE=M071R;LINKAGE=M3

 $\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.12 \pm 0.62 \pm 1.13$ -0.61	251 ± 22	ABLIKIM	12L BES3	$e^+ e^- \rightarrow \psi(2S)$

 Γ_{99}/Γ

NODE=M071S54
NODE=M071S54

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
10.9 ± 2.0 OUR AVERAGE				
$13.3^{+2.4}_{-2.8} \pm 1.7$	65.6 ± 9.0	ABLIKIM	05i BES2	$e^+ e^- \rightarrow \psi(2S)$
$9.2^{+2.7}_{-2.2} \pm 0.9$	25	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

 Γ_{100}/Γ

NODE=M071R30
NODE=M071R30

 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$

VALUE	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.06 OUR AVERAGE			
$0.22^{+0.10}_{-0.14}$	ABLIKIM	05i BES2	$e^+ e^- \rightarrow \psi(2S)$
$0.14^{+0.08}_{-0.06}$	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

 Γ_{88}/Γ_{100}

NODE=M071R46
NODE=M071R46

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{101}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID TECN COMMENT

1.62±0.11 OUR AVERAGE

Error includes scale factor of 1.1.

1.56±0.04±0.11 2.8k ABLIKIM 14G BES3 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ 2.38±0.37±0.29 78 ABLIKIM 06G BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ 1.9 ±0.3 ±0.3 76.8 BRIERE 05 CLEO $e^+ e^- \rightarrow \psi(2S) \rightarrow$ 1.5 ±0.3 ±0.2 23 ¹BAI 03B BES $K^+ K^- \pi^+ \pi^- \pi^0$
 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$ ¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.NODE=M071R78
NODE=M071R78

NODE=M071R78;LINKAGE=B3

 $\Gamma(\omega K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{102}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

7.04±0.39±0.36

1.5k

ABLIKIM 21AL BES3 $\psi(2S) \rightarrow \pi^+ \pi^- \pi^0 K_S^0 K_S^0$ NODE=M071P34
NODE=M071P34 $\Gamma(\omega K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{103}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

20.7±2.6 OUR AVERAGE18.9±2.9±2.2 396 ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ 22.6±3.0±2.4 535 ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K^+ K^- \pi^0$ NODE=M071S67
NODE=M071S67

OCCUR=2

 $\Gamma(\omega K_2^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{104}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

6.1 ±1.2 OUR AVERAGE6.39±1.50±0.78 128 ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ 5.86±1.61±0.83 143 ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K^+ K^- \pi^0$ NODE=M071S68
NODE=M071S68

OCCUR=2

 $\Gamma(\omega \bar{K}^*(892)^0 K^0)/\Gamma_{\text{total}}$ Γ_{105}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

16.8±2.5±1.6

356

ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ NODE=M071S69
NODE=M071S69 $\Gamma(\omega \bar{K}_2^*(1430)^0 K^0)/\Gamma_{\text{total}}$ Γ_{106}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

5.82±2.08±0.72

116

ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ NODE=M071S70
NODE=M071S70 $\Gamma(\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{107}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

1.60±0.27±0.24

109

¹ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ NODE=M071S71
NODE=M071S71¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S71;LINKAGE=AB

 $\Gamma(\omega X(1440) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{108}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

1.09±0.20±0.16

82

¹ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K^+ K^- \pi^0$ NODE=M071S72
NODE=M071S72¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S72;LINKAGE=AB

 $\Gamma(\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{109}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

0.302±0.098±0.027

22

¹ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$ NODE=M071S73
NODE=M071S73¹ Statistical significance 4.5 σ . This measurement is equivalent to a limit of $< 0.478 \times 10^{-5}$ at 90% C.L.

NODE=M071S73;LINKAGE=AB

 $\Gamma(\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{110}/Γ VALUE (units 10^{-5}) EVTS

DOCUMENT ID TECN COMMENT

0.125±0.070±0.013

10

¹ABLIKIM 13M BES3 $\psi(2S) \rightarrow \omega K^+ K^- \pi^0$ NODE=M071S74
NODE=M071S74¹ Statistical significance 3.2 σ . This measurement is equivalent to a limit of $< 0.221 \times 10^{-5}$ at 90% C.L.

NODE=M071S74;LINKAGE=AB

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

2.94±0.09 OUR FIT Error includes scale factor of 1.3. $[(2.94 \pm 0.08) \times 10^{-4}$ OUR 2023 FIT]

3.02±0.08 OUR AVERAGE

3.05±0.02±0.12	19k	ABLIKIM	18T	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
3.08±0.05±0.18	4.5k	¹ DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
3.36±0.09±0.25	1.6k	ABLIKIM	07C	BES	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.87±0.12±0.15	557	PEDLAR	05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
1.4 ±0.8	4	BRANDELIK	79C	DASP	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$
2.3 ±0.7		FELDMAN	77	MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R25
NODE=M071R25

NEW

NODE=M071R25;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_{111}/Γ_{12}

VALUE (units 10^{-4}) DOCUMENT ID TECN COMMENT

8.49±0.28 OUR FIT Error includes scale factor of 1.3. $[(8.49 \pm 0.23) \times 10^{-4}$ OUR 2023 FIT]

6.98±0.49±0.97 BAI 01 BES $e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

NODE=M071S40
NODE=M071S40

NEW

 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

3.06±0.06±0.14 6k ABLIKIM 18T BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow n\bar{n}$

NODE=M071P10
NODE=M071P10

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{113}/Γ

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

1.53±0.07 OUR AVERAGE

1.65±0.03±0.15	4.5k	ABLIKIM	13A	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$
1.54±0.06±0.06	948	ALEXANDER	10	CLEO	$\psi(2S) \rightarrow \pi^0 p\bar{p}$
1.32±0.10±0.15	256	¹ ABLIKIM	05E	BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\gamma\gamma$
1.4 ±0.5	9	FRANKLIN	83	MRK2	e^+e^-

¹ Computed using $B(\pi^0 \rightarrow \gamma\gamma) = (98.80 \pm 0.03)\%$.

NODE=M071R35
NODE=M071R35

NODE=M071R35;LINKAGE=AB

 $\Gamma(N(940)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

6.42±0.20^{+1.78}_{-1.28} 1.9k ¹ ABLIKIM 13A BES3 $\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S56
NODE=M071S56

NODE=M071S56;LINKAGE=AB

 $\Gamma(N(1440)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{115}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

7.3 ^{+1.7}_{-1.5} OUR AVERAGE Error includes scale factor of 2.5.

3.58±0.25 ^{+1.59} _{-0.84}	1.1k	¹ ABLIKIM	13A	BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$
8.1 ±0.7 ±0.3	474	² ALEXANDER	10	CLEO	$\psi(2S) \rightarrow \pi^0 p\bar{p}$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

² From a fit of the $p\bar{p}$ and $p\pi^0$ mass distributions to a combination of $N(1440)\bar{p}$, a broad $p\bar{p}$ enhancement around 2100 MeV, and two other broad, unestablished resonances.

NODE=M071S50
NODE=M071S50

NODE=M071S50;LINKAGE=AB
NODE=M071S50;LINKAGE=AL

 $\Gamma(N(1520)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

0.64±0.05^{+0.22}_{-0.17} 0.2k ¹ ABLIKIM 13A BES3 $\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S57
NODE=M071S57

NODE=M071S57;LINKAGE=AB

 $\Gamma(N(1535)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{117}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

2.47±0.28^{+0.99}_{-0.97} 0.7k ¹ ABLIKIM 13A BES3 $\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S58
NODE=M071S58

NODE=M071S58;LINKAGE=AB

 $\Gamma(N(1650)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

3.76±0.28^{+1.37}_{-1.66} 1.1k ¹ ABLIKIM 13A BES3 $\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S59
NODE=M071S59

NODE=M071S59;LINKAGE=AB

$$\Gamma(N(1720)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{119}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.79 \pm 0.10^{+0.24}_{-0.71}$	0.5k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S60
NODE=M071S60

NODE=M071S60;LINKAGE=AB

$$\Gamma(N(2300)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{120}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.62 \pm 0.28^{+1.12}_{-0.64}$	0.9k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S61
NODE=M071S61

NODE=M071S61;LINKAGE=AB

$$\Gamma(N(2570)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{121}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.13 \pm 0.08^{+0.40}_{-0.30}$	0.8k	¹ ABLIKIM	13A BES3	$\psi(2S) \rightarrow p\bar{p}\pi^0$

¹ From a fit of $\pi^0 p\bar{p}$ data to eight distinct intermediate $N\bar{p}$ resonant states.

NODE=M071S62
NODE=M071S62

NODE=M071S62;LINKAGE=AB

$$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{122}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				
$5.9 \pm 0.2 \pm 0.4$	904.5	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-$
8 ± 2		¹ TANENBAUM	78 MRK1	e^+e^-

¹ Assuming entirely strong decay.

NODE=M071R31
NODE=M071R31

NODE=M071R;LINKAGE=K

$$\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{123}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.7 ± 0.6 ± 0.4	30.1	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M071S16
NODE=M071S16

$$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}} \quad \Gamma_{124}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
6.0 ± 0.4 OUR AVERAGE				
$6.4 \pm 0.2 \pm 0.6$	679	¹ ABLIKIM	13s BES3	$\psi(2S) \rightarrow \eta p\bar{p}$
$5.6 \pm 0.6 \pm 0.3$	154	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta p\bar{p}$
$5.8 \pm 1.1 \pm 0.7$	44.8 ± 8.5	² ABLIKIM	05E BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\gamma\gamma$
$8 \pm 3 \pm 3$	9.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$

¹ With $N(1535)$ decaying to $p\eta$.

² Computed using $B(\eta \rightarrow \gamma\gamma) = (39.43 \pm 0.26)\%$.

NODE=M071R56
NODE=M071R56

NODE=M071R56;LINKAGE=A
NODE=M071R56;LINKAGE=AB

$$\Gamma(N(1535)\bar{p} + \text{c.c.} \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}} \quad \Gamma_{125}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
4.5 ± 0.7 OUR AVERAGE				
$5.2 \pm 0.3^{+3.2}_{-1.2}$	527	¹ ABLIKIM	13s BES3	$\psi(2S) \rightarrow \eta p\bar{p}$
$4.4 \pm 0.6 \pm 0.3$	123	² ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \eta p\bar{p}$

¹ With $N(1535)$ decaying to $p\eta$.

² From a fit of the $p\bar{p}$ and $p\eta$ distributions to a combination of $N^*(1535)\bar{p}$ and a broad $p\bar{p}$ enhancement around 2100 MeV.

NODE=M071S53
NODE=M071S53

NODE=M071S53;LINKAGE=A
NODE=M071S53;LINKAGE=AL

$$\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{126}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.4 ± 0.6	434.9	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$

NODE=M071S15
NODE=M071S15

$$\Gamma(p\bar{p}\rho^0)/\Gamma_{\text{total}} \quad \Gamma_{127}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.5 ± 0.1 ± 0.2	61.1	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-$

NODE=M071S14
NODE=M071S14

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ Γ_{128}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69±0.21 OUR AVERAGE				
0.6 ±0.2 ±0.2 21.2		BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$
0.8 ±0.3 ±0.1 14.9 ±0.1		¹ BAI	03B BES	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\pi^0$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R79
NODE=M071R79

NODE=M071R;LINKAGE=B3

$\Gamma(p\bar{p}\eta')/\Gamma_{\text{total}}$ Γ_{129}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10±0.10±0.08	491	¹ ABLIKIM	19N BES3	$\psi(2S) \rightarrow \eta' p\bar{p}$

¹ From the combination of $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\eta$ and $p\bar{p}\eta' \rightarrow p\bar{p}\pi^+\pi^-\gamma$ channels.

NODE=M071P20
NODE=M071P20

NODE=M071P20;LINKAGE=A

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.06±0.38±0.48		753	ABLIKIM	19AO BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<24	90		BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$
<26	90		¹ BAI	03B BES	$\psi(2S) \rightarrow K^+K^-p\bar{p}$

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R82
NODE=M071R82

NODE=M071R82;LINKAGE=B3

$\Gamma(\phi X(1835) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.82 × 10⁻⁷	90	ABLIKIM	19AO BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M071P21
NODE=M071P21

$\Gamma(p\bar{n}\pi^- \text{ or c.c.})/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.48±0.17 OUR AVERAGE				
2.45±0.11±0.21	851	ABLIKIM	06I BES2	$e^+e^- \rightarrow p\pi^-X$
2.52±0.12±0.22	849	ABLIKIM	06I BES2	$e^+e^- \rightarrow \bar{p}\pi^+X$

NODE=M071R01
NODE=M071R01

OCCUR=2

$\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.18±0.50±0.50	135 ± 21	ABLIKIM	06I BES2	$e^+e^- \rightarrow p\pi^-\pi^0X$

NODE=M071R02
NODE=M071R02

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{134}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.81±0.13 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.
3.97±0.02±0.12	31k		ABLIKIM	17L BES3	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
3.71±0.05±0.15	6.5k		¹ DOBBS	17	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
3.39±0.20±0.32	337		ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
6.4 ±1.8 ±0.1			² AUBERT	07BD BABR	10.6 $e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
3.28±0.23±0.25	208		PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.75±0.09±0.23	1.9k		^{1,3} DOBBS	14	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
1.81±0.20±0.27	80		⁴ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 4	90		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R28
NODE=M071R28

NODE=M071R28;LINKAGE=A
NODE=M071R28;LINKAGE=A

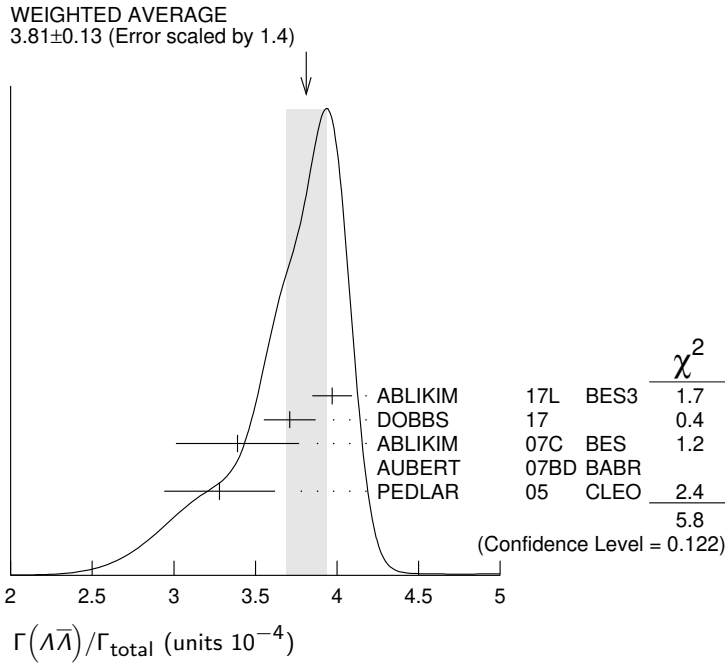
NODE=M071R28;LINKAGE=B
NODE=M071R28;LINKAGE=PP

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² AUBERT 07BD reports $[\Gamma(\psi(2S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (15 \pm 4 \pm 1) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by DOBBS 17.

⁴ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.



$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$

Γ_{135}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.39±0.59		23	¹ ABLIKIM	22AP BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 2.9	90		² ABLIKIM	13F BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
< 120	90		³ ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

¹ With a significance of 3.7 σ . The corresponding 90% CL upper limit is 2.47×10^{-6} .

² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.

³ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.

NODE=M071R6
NODE=M071R6

NODE=M071R6;LINKAGE=A
NODE=M071R6;LINKAGE=AL
NODE=M071R6;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$

Γ_{136}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.43±0.32 OUR AVERAGE					
2.34±0.18±0.52		218	ABLIKIM	22AP BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
2.48±0.34±0.19		60	¹ ABLIKIM	13F BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.9	90		² ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$
¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.31\%$.					
² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.					

NODE=M071R7
NODE=M071R7

NODE=M071R7;LINKAGE=AL
NODE=M071R7;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\eta')/\Gamma_{\text{total}}$

Γ_{138}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.34±0.94±0.43		218	ABLIKIM	23BV BES3	$\psi(2S) \rightarrow p\bar{p}2(\pi^+\pi^-\gamma)\gamma$

NODE=M071P52
NODE=M071P52

$\Gamma(\Lambda\bar{\Lambda}\omega(782))/\Gamma_{\text{total}}$

Γ_{139}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.30±0.34±0.29		207	¹ ABLIKIM	22AZ BES3	$e^+e^- \rightarrow \psi(2S)$
¹ Using $B(\Lambda \rightarrow \pi^- p) = 0.639$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = 0.893$.					

NODE=M071P46
NODE=M071P46

OCCUR=2

NODE=M071P46;LINKAGE=B

$\Gamma(\Lambda(1670)\bar{\Lambda} \rightarrow \Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$

Γ_{137}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.29±0.31±0.62		116	¹ ABLIKIM	22AP BES3	$\psi(2S) \rightarrow p\bar{p}\pi^+\pi^-\gamma\gamma$

¹ From a partial wave analysis of the $\Lambda\eta$ system.

NODE=M071P42
NODE=M071P42

NODE=M071P42;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$

Γ_{140}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.8±0.4±0.5		73.4	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}2(\pi^+\pi^-)$

NODE=M071S17
NODE=M071S17

$\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$ Γ_{141}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.1±0.1	74.0	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+\pi^-$

NODE=M071S18
 NODE=M071S18

 $\Gamma(\Lambda\bar{p}K^*(892)^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{142}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±0.5±0.5	1011	ABLIKIM	19AU BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P25
 NODE=M071P25

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{143}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±0.3±0.3	45.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+\pi^+\pi^-\pi^-$

NODE=M071S19
 NODE=M071S19

 $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.81±0.11±0.14	50	¹ ABLIKIM	08C BES2	$e^+e^- \rightarrow J/\psi$

NODE=M071R08
 NODE=M071R08

¹ Using $B(\bar{\Lambda} \rightarrow \bar{p}\pi^+) = 63.9\%$ and $B(K_S^0 \rightarrow \pi^+\pi^-) = 69.2\%$.

NODE=M071R08;LINKAGE=AB

 $\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$ Γ_{145}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
12.8±1.0±3.4	157	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R50
 NODE=M071R50

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R50;LINKAGE=PP

 $\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{146}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.40±0.03±0.13	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow \text{hadrons}$

NODE=M071S65
 NODE=M071S65

 $\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{147}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.54±0.04±0.13	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow \text{hadrons}$

NODE=M071S66
 NODE=M071S66

 $\Gamma(\Lambda\bar{\Sigma}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{148}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.60±0.31±0.59	60	ABLIKIM	21L BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P29
 NODE=M071P29

 $\Gamma(\Lambda\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{149}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT

NODE=M071P08
 NODE=M071P08

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.23±0.23±0.08 30 ¹ DOBBS 17 $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071P08;LINKAGE=A

 $\Gamma(\Sigma^0\bar{p}K^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{150}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.67±0.13±0.12	276	¹ ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{p}K^+$

NODE=M071S63
 NODE=M071S63

¹ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$, and $B(\Sigma^0 \rightarrow \Lambda\gamma) = 100\%$.

NODE=M071S63;LINKAGE=AB

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{151}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.43±0.10 OUR AVERAGE		Error includes scale factor of 1.4.		

NODE=M071R47
 NODE=M071R47

2.52±0.04±0.09	5.4k	ABLIKIM	21AT BES3	$\psi(2S) \rightarrow p\pi^0\bar{p}\pi^0$
2.31±0.06±0.10	1.9k	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.57±0.44±0.68	35	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.51±0.15±0.16 281 ^{1,2} DOBBS 14 $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Superseded by DOBBS 17.

NODE=M071R47;LINKAGE=A
 NODE=M071R47;LINKAGE=B

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.35±0.09 OUR AVERAGE		Error includes scale factor of 1.1.		
2.44±0.03±0.11	7k	ABLIKIM	17L BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.22±0.05±0.11	2.6k	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.35±0.36±0.32	59	ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.63±0.35±0.21	58	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.25±0.11±0.16	439	^{1,2} DOBBS	14	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
1.2 ±0.4 ±0.4	8	³ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.³ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R51
NODE=M071R51NODE=M071R51;LINKAGE=A
NODE=M071R51;LINKAGE=B
NODE=M071R51;LINKAGE=PP $\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82±0.04±0.08	6.6k	ABLIKIM	22AV BES3	$\psi(2S) \rightarrow n \pi^- \bar{n} \pi^+$

NODE=M071P41
NODE=M071P41 $\Gamma(\Sigma^+ \bar{\Sigma}^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
9.59±2.37±0.61	21	ABLIKIM	22AY BES3	$\psi(2S) \rightarrow \Sigma^+ \bar{\Sigma}^- \eta$

NODE=M071P45
NODE=M071P45 $\Gamma(\Sigma^+ \bar{\Sigma}^- \omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.89±0.18±0.21	199	ABLIKIM	23BE BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P50
NODE=M071P50 $\Gamma(\Sigma^+ \bar{\Sigma}^- \phi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
2.96±0.54±0.41	55	ABLIKIM	23BE BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P51
NODE=M071P51 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5±0.7 OUR AVERAGE				
8.4±0.5±0.5	1.5k	ABLIKIM	16L BES3	$\psi(2S) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-$
11 ±3 ±3	14	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R52
NODE=M071R52

OCCUR=2

NODE=M071R52;LINKAGE=PP

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5±0.6±0.6	1.4k	ABLIKIM	16L BES3	$\psi(2S) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+$

NODE=M071R00
NODE=M071R00 $\Gamma(\Sigma(1385)^0 \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69±0.05±0.05	2.2k	ABLIKIM	17E BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P00
NODE=M071P00 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.87±0.11 OUR AVERAGE			Error includes scale factor of 1.1.		
3.03±0.05±0.14	3.6k	¹ DOBBS	17		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.78±0.05±0.14	5k	ABLIKIM	16L BES3		$\psi(2S) \rightarrow \Xi^- \bar{\Xi}^+$
3.03±0.40±0.32	67	ABLIKIM	07C BES		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.38±0.30±0.21	63	PEDLAR	05 CLEO		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.66±0.12±0.20	548	^{1,2} DOBBS	14		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
0.94±0.27±0.15	12	³ BAI	01 BES		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
<2	90	FELDMAN	77 MRK1		$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.³ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R29
NODE=M071R29NODE=M071R29;LINKAGE=A
NODE=M071R29;LINKAGE=B
NODE=M071R29;LINKAGE=PP

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{161}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 $\pm$ 0.4 OUR AVERAGE		Error includes scale factor of 4.2.		
2.73 $\pm$ 0.03 $\pm$ 0.13	11k	ABLIKIM	17E BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
1.97 $\pm$ 0.06 $\pm$ 0.11	1.2k	¹ DOBBS	17	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.75 $\pm$ 0.64 $\pm$ 0.61	19	PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.02 $\pm$ 0.19 $\pm$ 0.15	112	^{1,2} DOBBS	14	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Superseded by DOBBS 17.NODE=M071R48
NODE=M071R48NODE=M071R48;LINKAGE=A
NODE=M071R48;LINKAGE=B $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$ Γ_{162}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.77 $\pm$ 0.14 $\pm$ 0.39		2951	ABLIKIM	21AO BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<32	90		PEDLAR	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 8.1	90		¹ BAI	01 BES	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R53
NODE=M071R53

NODE=M071R53;LINKAGE=PP

 $\Gamma(\Lambda \Xi^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{163}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.86 $\pm$ 0.27 $\pm$ 0.32	236	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S82
NODE=M071S82 $\Gamma(\Xi(1530)^- \Xi(1530)^+)/\Gamma_{\text{total}}$ Γ_{166}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
11.45 $\pm$ 0.40 $\pm$ 0.59	5k	ABLIKIM	19AT BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P26
NODE=M071P26 $\Gamma(\Xi(1530)^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{167}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0 $\pm$ 1.1 $\pm$ 0.4	399	ABLIKIM	19AT BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P27
NODE=M071P27 $\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{168}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.53 $\pm$ 0.04 $\pm$ 0.03	278	ABLIKIM	21AO BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P35
NODE=M071P35 $\Gamma(\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{164}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
5.21 $\pm$ 1.48 $\pm$ 0.57	74	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S83
NODE=M071S83 $\Gamma(\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{165}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
12.03 $\pm$ 2.94 $\pm$ 1.22	136	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S84
NODE=M071S84 $\Gamma(\Sigma^0 \Xi^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{169}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.67 $\pm$ 0.33 $\pm$ 0.28	142	ABLIKIM	15I BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^- \Sigma^0 \Xi^+ + \text{c.c.}$

NODE=M071S85
NODE=M071S85 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$ Γ_{170}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.66 $\pm$ 0.30 OUR AVERAGE			Error includes scale factor of 1.3.		
5.85 $\pm$ 0.12 $\pm$ 0.25	4k	¹ ABLIKIM	21E BES3		$\psi(2S) \rightarrow \Omega^- \bar{\Omega}^+ \rightarrow \Lambda K^- \bar{\Lambda} K^+$
5.2 $\pm$ 0.3 $\pm$ 0.3	326	^{1,2} DOBBS	17		$e^+ e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071R54
NODE=M071R54

• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.7 \pm 0.9 \pm 0.5$	27	^{1,2,3} DOBBS	14	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
<15	90	ABLIKIM	12Q BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
<16	90	PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons
< 7.3	90	⁴ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

¹ Using $B(\Omega^- \rightarrow \Lambda K^-) = (67.8 \pm 0.7)\%$ and $B(\Lambda \rightarrow p \pi^-) = (63.9 \pm 0.5)\%$.

² Using CLEO-c data but not authored by the CLEO Collaboration.

³ Superseded by DOBBS 17.

⁴ Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.

NODE=M071R54;LINKAGE=D
NODE=M071R54;LINKAGE=A
NODE=M071R54;LINKAGE=B
NODE=M071R54;LINKAGE=PP

$\Gamma(\eta_c \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$					Γ_{171}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.0	90	PEDLAR	07 CLEO	$e^+e^- \rightarrow \psi(2S)$	

NODE=M071R03
NODE=M071R03

$\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$					Γ_{172}/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	

7.4 ± 0.5 OUR AVERAGE

$7.32 \pm 0.34 \pm 0.41$	46k	ABLIKIM	22AQ BES3	$\psi(2S) \rightarrow \pi^0$ hadrons
$9.0 \pm 1.5 \pm 1.3$	3k	¹ GE	11 CLEO	$\psi(2S) \rightarrow \pi^0$ anything

• • • We do not use the following data for averages, fits, limits, etc. • • •

$8.4 \pm 1.3 \pm 1.0$	11k	² ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 h_c$
seen	92^{+23}_{-22}	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2\pi^+ 2\pi^- 2\pi^0$
seen	1282	DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
seen	168 ± 40	ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

¹ Assuming a width $\Gamma(h_c(1P)) = 0.86 \text{ MeV} \equiv \Gamma_0$, a measured dependence of the central value of $B = (7.6 + 1.4 \times \Gamma(h_c(1P)/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

² Superseded by ABLIKIM 22AQ

NODE=M071S42
NODE=M071S42

NODE=M071S42;LINKAGE=GE

NODE=M071S42;LINKAGE=A

$\Gamma(\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{173}/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 1.7×10^{-6}	90	450M	ABLIKIM	18Q BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P11
NODE=M071P11

$\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$					Γ_{174}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.88	90	BAI	04G BES2	e^+e^-	

NODE=M071S01
NODE=M071S01

$\Gamma(\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$					Γ_{175}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.0	90	BAI	04G BES2	e^+e^-	

NODE=M071S02
NODE=M071S02

$\Gamma(\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$					Γ_{176}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.70	90	BAI	04G BES2	e^+e^-	

NODE=M071S03
NODE=M071S03

$\Gamma(\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n)/\Gamma_{\text{total}}$					Γ_{177}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<2.6	90	BAI	04G BES2	e^+e^-	

NODE=M071S04
NODE=M071S04

$\Gamma(\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n})/\Gamma_{\text{total}}$					Γ_{178}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.60	90	BAI	04G BES2	e^+e^-	

NODE=M071S05
NODE=M071S05

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$
 Γ_{179}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
9.77 ± 0.23 OUR FIT		Error includes scale factor of 1.1. $[(9.79 \pm 0.20) \times 10^{-2}]$ OUR 2023 FIT]		
9.33 ± 0.26 OUR AVERAGE				
9.389 $\pm 0.014 \pm 0.332$	4.7M	ABLIKIM	17U	BES3 $e^+e^- \rightarrow \gamma X$
9.22 $\pm 0.11 \pm 0.46$	72k	ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$
9.9 $\pm 0.5 \pm 0.8$		¹ GAISER	86	CBAL $e^+e^- \rightarrow \gamma X$
7.2 ± 2.3		¹ BIDDICK	77	CNTR $e^+e^- \rightarrow \gamma X$
7.5 ± 2.6		¹ WHITAKER	76	MRK1 e^+e^-

¹ Angular distribution $(1+\cos^2\theta)$ assumed.

 $\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$
 Γ_{180}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
9.75 ± 0.27 OUR FIT		Error includes scale factor of 1.1. $[(9.75 \pm 0.24) \times 10^{-2}]$ OUR 2023 FIT]		
9.54 ± 0.29 OUR AVERAGE				
9.905 $\pm 0.011 \pm 0.353$	5.0M	ABLIKIM	17U	BES3 $e^+e^- \rightarrow \gamma X$
9.07 $\pm 0.11 \pm 0.54$	76k	ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$
9.0 $\pm 0.5 \pm 0.7$		¹ GAISER	86	CBAL $e^+e^- \rightarrow \gamma X$
7.1 ± 1.9		² BIDDICK	77	CNTR $e^+e^- \rightarrow \gamma X$

¹ Angular distribution $(1-0.189 \cos^2\theta)$ assumed.

² Valid for isotropic distribution of the photon.

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c1}(1P))$
 $\Gamma_{179}/\Gamma_{180}$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.02 $\pm 0.01 \pm 0.07$	¹ ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$

¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.

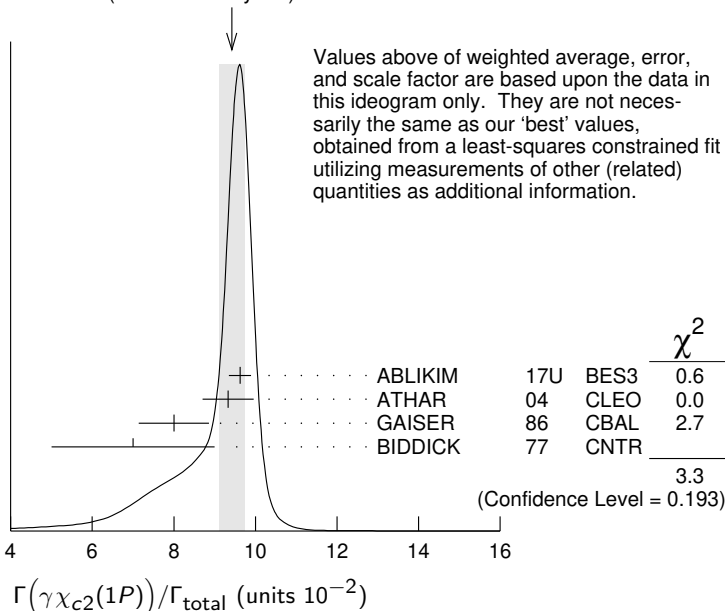
 $\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$
 Γ_{181}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
9.36 ± 0.23 OUR FIT		Error includes scale factor of 1.2. $[(9.52 \pm 0.20) \times 10^{-2}]$ OUR 2023 FIT]		
9.42 ± 0.31 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
9.621 $\pm 0.013 \pm 0.272$	4.2M	ABLIKIM	17U	BES3 $e^+e^- \rightarrow \gamma X$
9.33 $\pm 0.14 \pm 0.61$	79k	ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$
8.0 $\pm 0.5 \pm 0.7$		¹ GAISER	86	CBAL $e^+e^- \rightarrow \gamma X$
7.0 ± 2.0		² BIDDICK	77	CNTR $e^+e^- \rightarrow \gamma X$

¹ Angular distribution $(1-0.052 \cos^2\theta)$ assumed.

² Valid for isotropic distribution of the photon.

WEIGHTED AVERAGE
9.42 $\pm$ 0.31 (Error scaled by 1.3)



NODE=M071315

NODE=M071R55
NODE=M071R55

NEW

NODE=M071R;LINKAGE=A

NODE=M071R58
NODE=M071R58

NEW

NODE=M071R;LINKAGE=G
NODE=M071R;LINKAGE=BNODE=M071R97
NODE=M071R97

NODE=M071R97;LINKAGE=AH

NODE=M071R59
NODE=M071R59

NEW

NODE=M071R;LINKAGE=F
NODE=M071R59;LINKAGE=B

$$\frac{[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{179} + \Gamma_{180} + \Gamma_{181}}{\Gamma_{\text{total}}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

27.6 ± 0.3 ± 2.0 ¹ ATHAR 04 CLEO e⁺e⁻ → γX

¹ Not independent from ATHAR 04 measurements of B(γχ_{cJ}).

NODE=M071R19
NODE=M071R19

NODE=M071R;LINKAGE=AH

$$\frac{\Gamma(\gamma\chi_{c0}(1P))}{\Gamma(\gamma\chi_{c2}(1P))} \quad \frac{\Gamma_{179}}{\Gamma_{181}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.99 ± 0.02 ± 0.08 ¹ ATHAR 04 CLEO e⁺e⁻ → γX

¹ Not independent from ATHAR 04 measurements of B(γχ_{cJ}).

NODE=M071R99
NODE=M071R99

NODE=M071R99;LINKAGE=AH

$$\frac{\Gamma(\gamma\chi_{c2}(1P))}{\Gamma(\gamma\chi_{c1}(1P))} \quad \frac{\Gamma_{181}}{\Gamma_{180}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.03 ± 0.02 ± 0.03 ¹ ATHAR 04 CLEO e⁺e⁻ → γX

¹ Not independent from ATHAR 04 measurements of B(γχ_{cJ}).

NODE=M071R98
NODE=M071R98

NODE=M071R98;LINKAGE=AH

$$\frac{\Gamma(\gamma\eta_c(1S))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{182}}{\Gamma_{\text{total}}}$$

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT

0.36 ± 0.05 OUR FIT Error includes scale factor of 1.3.

0.34 ± 0.05 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

0.432 ± 0.016 ± 0.060 MITCHELL 09 CLEO e⁺e⁻ → γX

0.32 ± 0.04 ± 0.06 2.5k ¹ ATHAR 04 CLEO e⁺e⁻ → γX

0.28 ± 0.06 ² GAISER 86 CBAL e⁺e⁻ → γX

¹ ATHAR 04 used Γ_{η_c(1S)} = 24.8 ± 4.9 MeV to obtain this result.

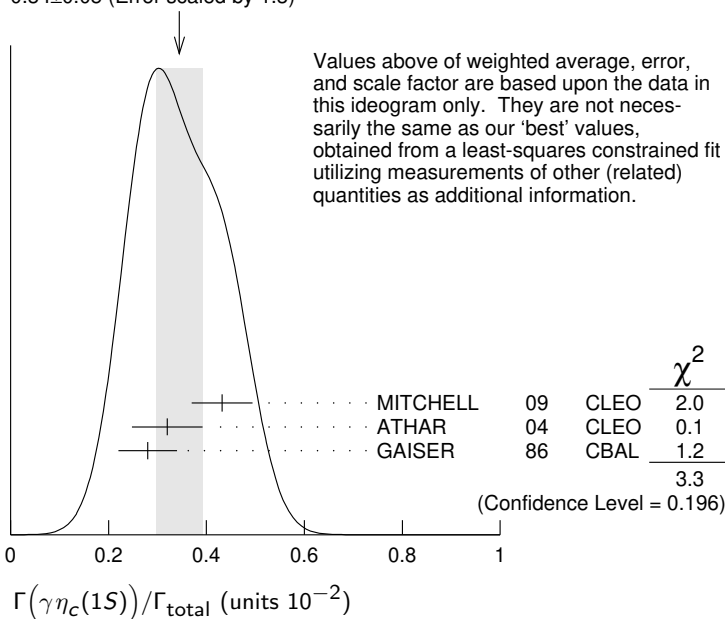
² GAISER 86 used Γ_{η_c(1S)} = 11.5 ± 4.5 MeV to obtain this result.

NODE=M071R60
NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

WEIGHTED AVERAGE
0.34 ± 0.05 (Error scaled by 1.3)



$$\frac{\Gamma(\gamma\eta_c(2S))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{183}}{\Gamma_{\text{total}}}$$

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

7 ± 2 ± 4

¹ ABLIKIM 12G BES3 ψ(2S) → γK⁰Kπ,
KKπ⁰

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8 90 ² CRONIN-HEN..10 CLEO ψ(2S) → γK⁰K̄π

< 20 90 ATHAR 04 CLEO e⁺e⁻ → γX

20-130 95 EDWARDS 82C CBAL e⁺e⁻ → γX

NODE=M071R62
NODE=M071R62

¹ ABLIKIM 12G reports $[\Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] = (1.30 \pm 0.20 \pm 0.30) \times 10^{-5}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = (1.9 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² CRONIN-HENNESSY 10 reports $[\Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K \bar{K} \pi)] < 14.5 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = 1.9 \times 10^{-2}$. This measurement assumes $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M071R62;LINKAGE=AB

NODE=M071R62;LINKAGE=CR

$\Gamma(\gamma \pi^0)/\Gamma_{\text{total}}$ Γ_{184}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.04 ± 0.22 OUR AVERAGE			Error includes scale factor of 1.4.		
0.95 ± 0.16 ± 0.05		423	ABLIKIM	17X BES3	$\psi(2S) \rightarrow \gamma \pi^0$
1.58 ± 0.40 ± 0.13		37	ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 5	90	PEDLAR	09	CLE3	$\psi(2S) \rightarrow \gamma X$
< 5400	95	¹ LIBERMAN	75	SPEC	$e^+ e^-$
< 1×10^4	90	WIK	75	DASP	$e^+ e^-$

¹ Restated by us using $B(\psi(2S) \rightarrow \mu^+ \mu^-) = 0.0077$.

NODE=M071R42
NODE=M071R42

NODE=M071R;LINKAGE=U

$\Gamma(\gamma 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{185}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
39.6 ± 2.8 ± 5.0	583	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S28
NODE=M071S28

$\Gamma(\gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{186}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 17	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S36
NODE=M071S36

$\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$ Γ_{187}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.24 ± 0.04 OUR AVERAGE					
1.251 ± 0.022 ± 0.062		56k	ABLIKIM	17X BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \eta$, $\gamma \pi^0 \pi^0 \eta$
1.26 ± 0.03 ± 0.08		2226	¹ ABLIKIM	10F BES3	$\psi(2S) \rightarrow 3 \gamma \pi^+ \pi^-$, $2 \gamma \pi^+ \pi^-$
1.19 ± 0.08 ± 0.03			PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$
1.24 ± 0.27 ± 0.15	23		ABLIKIM	06R BES2	$e^+ e^- \rightarrow \psi(2S)$
1.54 ± 0.31 ± 0.20	~ 43		BAI	98F BES	$\psi(2S) \rightarrow \pi^+ \pi^- 2 \gamma$, $\pi^+ \pi^- 3 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 60	90	² BRAUNSCH...	77	DASP	$e^+ e^-$
< 11	90	³ BARTEL	76	CNTR	$e^+ e^-$

¹ Combining the results from $\eta' \rightarrow \pi^+ \pi^- \eta$ and $\eta' \rightarrow \pi^+ \pi^- \gamma$ decay modes.

² Restated by us using total decay width 228 keV.

³ The value is normalized to the branching ratio for $\Gamma(J/\psi(1S)\eta)/\Gamma_{\text{total}}$.

NODE=M071R44
NODE=M071R44NODE=M071R44;LINKAGE=AB
NODE=M071R;LINKAGE=R
NODE=M071R;LINKAGE=C

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{188}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.73^{+0.29}_{-0.25} OUR AVERAGE				Error includes scale factor of 1.8.

2.84 ± 0.15 ^{+0.03} _{-0.10}	1.9k	^{1,2} DOBBS	15	$\psi(2S) \rightarrow \gamma \pi \pi$
2.12 ± 0.19 ± 0.32		^{3,4} BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi \pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.08 ± 0.19 ± 0.33	200.6 ± 18.8	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
2.90 ± 1.08 ± 1.07	29.9 ± 11.1	³ BAI	03C BES	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_2(1270))/\Gamma_{\text{total}}] \times [B(f_2(1270) \rightarrow \pi \pi)] = (2.39 \pm 0.09 \pm 0.09) \times 10^{-4}$ which we divide by our best value $B(f_2(1270) \rightarrow \pi \pi) = (84.3^{+2.8}_{-1.0}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

⁴ Combining the results from $\pi^+ \pi^-$ and $\pi^0 \pi^0$ decay modes.

NODE=M071R84
NODE=M071R84OCCUR=2
OCCUR=3NODE=M071R84;LINKAGE=A
NODE=M071R84;LINKAGE=BNODE=M071R;LINKAGE=3B
NODE=M071R;LINKAGE=B9

$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{189}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
3.1±1.0±1.4	175	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S75
 NODE=M071S75

NODE=M071S75;LINKAGE=A

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ Γ_{190}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
9.3±1.8±0.6	274	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f_0(1500))/\Gamma_{\text{total}}] \times [B(f_0(1500) \rightarrow \pi \pi)] = (3.2 \pm 0.6 \pm 0.2) \times 10^{-5}$ which we divide by our best value $B(f_0(1500) \rightarrow \pi \pi) = (34.5 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S76
 NODE=M071S76

NODE=M071S76;LINKAGE=A

NODE=M071S76;LINKAGE=B

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{191}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
3.3±0.8±0.1	136	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

¹ DOBBS 15 reports $[\Gamma(\psi(2S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})] = (2.9 \pm 0.6 \pm 0.3) \times 10^{-5}$ which we divide by our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S77
 NODE=M071S77

NODE=M071S77;LINKAGE=A

NODE=M071S77;LINKAGE=B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{193}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ±0.6 OUR AVERAGE				
3.6 ±0.4 ±0.5	290	¹ DOBBS 15		$\psi(2S) \rightarrow \gamma \pi \pi$
3.01±0.41±1.24	35.6 ± 4.8	² BAI 03C	BES	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R85
 NODE=M071R85

NODE=M071R85;LINKAGE=A

NODE=M071R85;LINKAGE=3B

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{194}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.6 ±0.7 OUR AVERAGE					
6.7 ±0.6 ±0.6		375	¹ DOBBS 15		$\psi(2S) \rightarrow \gamma K \bar{K}$
6.04±0.90±1.32	39.6 ± 5.9	^{2,3} BAI 03C	BES		$\psi(2S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 15.6	90	6.8 ± 3.1	^{2,3} BAI 03C	BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Includes unknown branching fractions to $K^+ K^-$ or $K_S^0 K_S^0$. We have multiplied the $K^+ K^-$ result by a factor of 2 and the $K_S^0 K_S^0$ result by a factor of 4 to obtain the $K \bar{K}$ result.

³ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R86
 NODE=M071R86

OCCUR=2

NODE=M071R86;LINKAGE=A

NODE=M071R;LINKAGE=CK

NODE=M071R86;LINKAGE=3B

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{195}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
4.8±0.5±0.9	373	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S78
 NODE=M071S78

NODE=M071S78;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{196}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT
3.2±0.6±0.8	207	¹ DOBBS 15	$\psi(2S) \rightarrow \gamma K \bar{K}$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071S79
 NODE=M071S79

NODE=M071S79;LINKAGE=A

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{197}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<5.8 × 10⁻⁶	90	^{1,2} DOBBS 15	$\psi(2S) \rightarrow \gamma \pi \pi$

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $\pi^+ \pi^-$ and $\pi^0 \pi^0$ are $3.2/4.3 \times 10^{-6}$ and $2.6/4.0 \times 10^{-6}$, respectively.

NODE=M071S80
 NODE=M071S80

NODE=M071S80;LINKAGE=A

NODE=M071S80;LINKAGE=D0

$\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{198}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9.5 \times 10^{-6}$	90	1,2 DOBBS 15		$\psi(2S) \rightarrow \gamma K \bar{K}$

NODE=M071S81
 NODE=M071S81

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² For $\Gamma = 20/50$ MeV, the 90% CL upper limits for $K^+ K^-$ and $K_S^0 K_S^0$ are $2.1/4.3 \times 10^{-6}$ and $3.7/5.5 \times 10^{-6}$, respectively.

NODE=M071S81;LINKAGE=A
 NODE=M071S81;LINKAGE=DO

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ Γ_{199}/Γ

VALUE (units 10^{-6})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.92 ± 0.18 OUR AVERAGE					
0.85 ± 0.18 ± 0.04	382		¹ ABLIKIM	17X BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$
1.38 ± 0.48 ± 0.09	13		¹ ABLIKIM	10F BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$

NODE=M071R43
 NODE=M071R43

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2	90	PEDLAR	09	CLE3	$\psi(2S) \rightarrow \gamma X$
< 90	90	BAI	98F	BES	$\psi(2S) \rightarrow \pi^+ \pi^- 3\gamma$
< 200	90	YAMADA	77	DASP	$e^+ e^- \rightarrow 3\gamma$

¹ Combining the results from $\eta \rightarrow \pi^+ \pi^- \pi^0$ and $\eta \rightarrow 3\pi^0$ decay modes.

NODE=M071R43;LINKAGE=AB

 $\Gamma(\gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{200}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
8.71 ± 1.25 ± 1.64	418	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R04
 NODE=M071R04

 $\Gamma(\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{202}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^- + \text{c.c.}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.3	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$
<1.2	90	¹ SCHARRE	80 MRK1	$e^+ e^-$

¹ Includes unknown branching fraction $\eta(1405) \rightarrow K \bar{K} \pi$.

OCCUR=2

NODE=M071R;LINKAGE=E

 $\Gamma(\gamma \eta(1405) \rightarrow \gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{203}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.25 ± 0.05	10	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R05
 NODE=M071R05

 $\Gamma(\gamma \eta(1405) \rightarrow \gamma f_0(980) \pi^0 \rightarrow \gamma \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{204}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.0 × 10⁻⁷	90	ABLIKIM	17AJ BES3	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$

NODE=M071P09
 NODE=M071P09

 $\Gamma(\gamma \eta(1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ Γ_{206}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.5	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^- + \text{c.c.}$

NODE=M071R06
 NODE=M071R06

OCCUR=2

 $\Gamma(\gamma \eta(1475) \rightarrow \gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{207}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M071R07
 NODE=M071R07

 $\Gamma(\gamma K^* K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{208}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
37.0 ± 6.1 ± 7.2	237	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S29
 NODE=M071S29

 $\Gamma(\gamma K^* K^0 \bar{K}^0)/\Gamma_{\text{total}}$ Γ_{209}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
24.0 ± 4.5 ± 5.0	41	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S30
 NODE=M071S30

 $\Gamma(\gamma K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{210}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
25.6 ± 3.6 ± 3.6	115	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S31
 NODE=M071S31

$$\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{211}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
19.1±2.7±4.3	132	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S32
NODE=M071S32

$$\Gamma(\gamma K^+ K^- 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{212}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<22	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S35
NODE=M071S35

$$\Gamma(\gamma 2(K^+ K^-))/\Gamma_{\text{total}} \quad \Gamma_{213}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S37
NODE=M071S37

$$\Gamma(\gamma p \bar{p})/\Gamma_{\text{total}} \quad \Gamma_{214}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9 ±0.5 OUR AVERAGE		Error includes scale factor of 2.0.		
4.18±0.26±0.18	348	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
2.9 ±0.4 ±0.4	142	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S33
NODE=M071S33

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S33;LINKAGE=AL

$$\Gamma(\gamma f_2(1950) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}} \quad \Gamma_{215}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
1.2±0.2±0.1	111	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S46
NODE=M071S46

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S46;LINKAGE=AL

$$\Gamma(\gamma f_2(2150) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}} \quad \Gamma_{216}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
0.72±0.18±0.03	73	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S47
NODE=M071S47

¹ From a fit of the $p\bar{p}$ mass distribution to a combination of $\gamma f_2(1950)$, $\gamma f_2(2150)$, and $\gamma p\bar{p}$ phase space, for $M(p\bar{p}) < 2.85$ GeV, and accounting for backgrounds from $\psi(2S) \rightarrow \pi^0 p\bar{p}$ and continuum.

NODE=M071S47;LINKAGE=AL

$$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}} \quad \Gamma_{217}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
4.57±0.36^{+1.77}_{-4.26}		ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p \bar{p}$

NODE=M071S48
NODE=M071S48

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.6	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$
<5.4	90	ABLIKIM	07D BES	$\psi(2S) \rightarrow \gamma p \bar{p}$

$$\Gamma(\gamma X \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}} \quad \Gamma_{218}/\Gamma$$

For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p \bar{p}$

NODE=M071S49
NODE=M071S49
NODE=M071S49

$$\Gamma(\gamma p \bar{p} \pi^+ \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{219}/\Gamma$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.8±1.2±0.7	17	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S34
NODE=M071S34

$$\Gamma(\gamma \gamma J/\psi)/\Gamma_{\text{total}} \quad \Gamma_{221}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.1±0.6^{+0.8}_{-1.0}	1.1k	ABLIKIM	120 BES3	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S55
NODE=M071S55

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.2±0.6	1.1k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma J/\psi$

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.961 \pm 0.033)\%$. No systematic error estimation.

NODE=M071S55;LINKAGE=A

$\Gamma(e^+e^-\eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
1.90±0.26 OUR AVERAGE				
1.99±0.33±0.12	57	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$, $\eta' \rightarrow \gamma \pi^+ \pi^-$
1.79±0.38±0.11	20	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$, $\eta' \rightarrow \eta \pi^+ \pi^-$

 Γ_{222}/Γ NODE=M071P12
NODE=M071P12

OCCUR=2

 $\Gamma(e^+e^-\eta_c(1S))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.77±0.40±0.18				
	3k	¹ ABLIKIM	22AX BES3	$e^+e^- \rightarrow \psi(2S)$

 Γ_{223}/Γ NODE=M071P44
NODE=M071P44¹ From a fit to the recoil mass distribution of e^+e^- with inclusive $\eta_c(1S)$ decays.

NODE=M071P44;LINKAGE=A

 $\Gamma(e^+e^-\chi_{c0}(1P))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
10.6±2.5 OUR AVERAGE [(10.6 ± 2.4) × 10 ⁻⁴ OUR 2023 AVERAGE]				
10.6±2.4±0.7	48	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

 Γ_{224}/Γ NODE=M071P01
NODE=M071P01

NEW

NODE=M071P01;LINKAGE=B

¹ ABLIKIM 17I reports (11.7 ± 2.5 ± 1.0) × 10⁻⁴ from a measurement of [$\Gamma(\psi(2S) \rightarrow e^+e^-\chi_{c0}(1P))/\Gamma_{\text{total}}$] × [$B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))$] assuming $B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (1.27 \pm 0.06) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (1.41 \pm 0.09) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. $\Gamma(e^+e^-\chi_{c0}(1P))/\Gamma(\gamma\chi_{c0}(1P))$ $\Gamma_{224}/\Gamma_{179}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
9.4±1.9±0.6				
	48	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P04
NODE=M071P04¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) \times B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (15.8 \pm 0.3 \pm 0.6) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P04;LINKAGE=A

 $\Gamma(e^+e^-\chi_{c1}(1P))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
8.5±0.7 OUR AVERAGE [(8.5 ± 0.6) × 10 ⁻⁴ OUR 2023 AVERAGE]				
8.5±0.6±0.3	873	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

 Γ_{225}/Γ NODE=M071P02
NODE=M071P02

NEW

NODE=M071P02;LINKAGE=B

¹ ABLIKIM 17I reports (8.6 ± 0.3 ± 0.6) × 10⁻⁴ from a measurement of [$\Gamma(\psi(2S) \rightarrow e^+e^-\chi_{c1}(1P))/\Gamma_{\text{total}}$] × [$B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))$] assuming $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (33.9 \pm 1.2) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (34.3 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. $\Gamma(e^+e^-\chi_{c1}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{225}/\Gamma_{180}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
8.3±0.3±0.4				
	873	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P05
NODE=M071P05¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (351.8 \pm 1.0 \pm 12.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P05;LINKAGE=A

 $\Gamma(e^+e^-\chi_{c2}(1P))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
6.8±0.8 OUR AVERAGE [(7.0 ± 0.8) × 10 ⁻⁴ OUR 2023 AVERAGE]				
6.8±0.7±0.3	227	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

 Γ_{226}/Γ NODE=M071P03
NODE=M071P03

NEW

NODE=M071P03;LINKAGE=B

¹ ABLIKIM 17I reports (6.9 ± 0.5 ± 0.6) × 10⁻⁴ from a measurement of [$\Gamma(\psi(2S) \rightarrow e^+e^-\chi_{c2}(1P))/\Gamma_{\text{total}}$] × [$B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))$] assuming $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.2 \pm 0.7) \times 10^{-2}$, which we rescale to our best value $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.5 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. $\Gamma(e^+e^-\chi_{c2}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{226}/\Gamma_{181}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
6.6±0.5±0.4				
	227	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^-\gamma J/\psi$

NODE=M071P06
NODE=M071P06¹ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) \times B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (199.6 \pm 0.8 \pm 7.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

NODE=M071P06;LINKAGE=A

WEAK DECAYS

$\Gamma(D^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$		Γ_{227}/Γ		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-7}$	90	¹ ABLIKIM	17AF BES3	$e^+ e^- \rightarrow \psi(2S)$
¹ Using D^0 decays to $K^- \pi^+$, $K^- \pi^+ \pi^0$, and $K^- \pi^+ \pi^+ \pi^-$.				

$\Gamma(\Lambda_c^+ \bar{\Sigma}^- + \text{c.c.})/\Gamma_{\text{total}}$		Γ_{228}/Γ		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.4 \times 10^{-5}$	90	¹ ABLIKIM	23 BES3	$e^+ e^- \rightarrow \psi(2S)$
¹ Using $\Lambda_c^+ \rightarrow p K^- \pi^+$ and $\bar{\Sigma}^- \rightarrow \bar{p} \pi^0$.				

OTHER DECAYS

$\Gamma(\text{invisible})/\Gamma(e^+ e^-)$		Γ_{229}/Γ_7		
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.0	90	LEES	13I BABR	$B \rightarrow K^{(*)} \psi(2S)$

 $\psi(2S)$ CROSS-PARTICLE BRANCHING RATIOS

For measurements involving $B(\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)) \times B(\chi_{cJ}(1P) \rightarrow X)$ see the corresponding entries in the $\chi_{cJ}(1P)$ sections.

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

 $\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)$ and $\chi_{cJ} \rightarrow \gamma J/\psi(1S)$ $a_2(\chi_{c1})/a_2(\chi_{c2})$ Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
63 ± 7 OUR AVERAGE				
61.7 ± 8.3	253k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
67 ⁺¹⁹ ₋₁₃	59k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined.

² Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $a_2(\chi_{c1}(1P))$ and $a_2(\chi_{c2}(1P))$ from ARTUSO 09.

 $b_2(\chi_{c2})/b_2(\chi_{c1})$ Magnetic quadrupole transition amplitude ratio

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
60 ± 31 OUR AVERAGE				
74 ± 40	253k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
37 ⁺⁵³ ₋₄₇	59k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Statistical and systematic errors combined. Derived from the reported measurement of $b_2(\chi_{c1})/b_2(\chi_{c2}) = 1.35 \pm 0.72$.

² Statistical and systematic errors combined. Using values from fits with floating $M2$ amplitudes $a_2(\chi_{c1})$, $a_2(\chi_{c2})$, $b_2(\chi_{c1})$, $b_2(\chi_{c2})$ and fixed $E3$ amplitudes of $a_3(\chi_{c2}) = b_3(\chi_{c2}) = 0$. Not independent of values for $b_2(\chi_{c1}(1P))$ and $b_2(\chi_{c2}(1P))$ from ARTUSO 09.

 $\psi(2S)$ REFERENCES

AAIJ	23AP	JHEP 2307 084	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	23	CP C47 013002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BA	PR D108 052001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BE	PR D108 092011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BV	PR D108 112014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	23	PR D107 072001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LIAO	23	PR D107 112007	L. Liao <i>et al.</i>	
ABLIKIM	22AP	PR D106 072006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AQ	PR D106 072007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AV	JHEP 2212 016	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AX	PR D106 112002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AY	PR D106 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AZ	PR D106 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)
ABLIKIM	21AL	PR D104 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AO	PR D104 092012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AT	JHEP 2111 226	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21E	PRL 126 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21L	PR D103 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21S	PL B820 136576	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21Z	PRL 127 082002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	21	PR D103 092001	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	21C	PR D104 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)

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ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19AO	PR D99 112010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59892
ABLIKIM	19AT	PR D100 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59989
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59996
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
ABLIKIM	19I	PR D99 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59605
ABLIKIM	19N	PR D99 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59615
ABLIKIM	18Q	PR D97 091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58933
ABLIKIM	18T	PR D98 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58975
ABLIKIM	18Z	PL B783 452	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59038
ANASHIN	18	PL B781 174	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=59013
LEES	18E	PR D98 112015	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=59505
ABLIKIM	17AF	PR D96 111101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58315
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58322
ABLIKIM	17AK	PR D96 112012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58324
ABLIKIM	17E	PL B770 217	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57903
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57931
ABLIKIM	17L	PR D95 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57967
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57978
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58026
ABLIKIM	17X	PR D96 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58216
DOBBS	17	PR D96 092004	S. Dobbs <i>et al.</i>	(NWES, WAYN)	REFID=58670
LEES	17A	PR D95 052001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57966
AAIJ	16Y	JHEP 1605 132	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57333
ABLIKIM	16L	PR D93 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57510
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56774
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56787
ANASHIN	15	PL B749 50	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=56792
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	15J	PR D92 072008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56988
ABLIKIM	14G	PR D89 112006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55898
DOBBS	14	PL B739 90	S. Dobbs <i>et al.</i>	(NWES, WAYN)	REFID=56333
ABLIKIM	13A	PRL 110 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54834
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54879
ABLIKIM	13F	PR D87 052007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54920
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55386
ABLIKIM	13R	PR D88 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55402
ABLIKIM	13S	PR D88 032010	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55403
ABLIKIM	13W	PR D88 112007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55634
LEES	13I	PR D87 112005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55161
LEES	13O	PR D87 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55293
LEES	13Q	PR D88 032013	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55404
LEES	13Y	PR D88 072009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55589
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
ABLIKIM	12D	PRL 108 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54269
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54272
ABLIKIM	12H	PL B710 594	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54273
ABLIKIM	12L	PR D86 072011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54739
ABLIKIM	12M	PR D86 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54740
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54742
ABLIKIM	12Q	CP C36 1040	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=54864
ANASHIN	12	PL B711 280	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54038
LEES	12E	PR D85 112009	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54297
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
METREVELI	12	PR D85 092007	Z. Metreveli <i>et al.</i>	(NWES, FLOR, WAYN+)	REFID=54304
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
ABLIKIM	10B	PRL 104 132002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53348
ABLIKIM	10F	PRL 105 261801	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53630
ALEXANDER	10	PR D82 092002	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=53525
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)	REFID=53233
ADAMS	09	PR D80 051106	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=53103
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=53206
LIBBY	09	PR D80 072002	J. Libby <i>et al.</i>	(CLEO Collab.)	REFID=53124
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)	REFID=52676
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08C	PL B659 789	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52130
DOBBS	08A	PRL 101 182003	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52579
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)	REFID=52684
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ABLIKIM	07C	PL B648 149	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51636
ABLIKIM	07D	PRL 99 011802	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=51725
ABLIKIM	07H	PR D76 092003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52046
ANASHIN	07	JETPL 85 347	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=51655
		Translated from ZETFP 85 429.			
ANDREOTTI	07	PL B654 74	M. Andreotti <i>et al.</i>	(Femilab E835 Collab.)	REFID=51944
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
Also		PR D77 119902E (errat.)	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52266
AUBERT	07BD	PR D76 092006	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52050
PDG	07	Unofficial 2007 WWW edition		(PDG Collab.)	REFID=52717; ERROR=8
PEDLAR	07	PR D75 011102	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=51630
ABLIKIM	06G	PR D73 052004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51048
ABLIKIM	06I	PR D74 012004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51126
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51447
ABLIKIM	06W	PR D74 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51560
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT	06D	PR D73 052003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51047
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511

DOBBS	06A	PR D74 011105	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=51158
ABLIKIM	05E	PR D71 072006	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50757
ABLIKIM	05H	PR D72 012002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50759
ABLIKIM	05I	PL B614 37	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50758
ABLIKIM	05J	PL B619 247	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50760
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50846
ADAM	05	PRL 94 012005	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50451
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50763
ANDREOTTI	05	PR D71 032006	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)	REFID=50497
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
BRIERE	05	PRL 95 062001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50785
PEDLAR	05	PR D72 051108	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=50808
ROSNER	05	PRL 95 102003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=50812
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=49741
ABLIKIM	04K	PR D70 112003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50327
ABLIKIM	04L	PR D70 112007	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50328
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
BAI	04B	PRL 92 052001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49608
BAI	04C	PR D69 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49749
BAI	04D	PL B589 7	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49750
BAI	04G	PR D70 012004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49753
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49755
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
SETH	04	PR D69 097503	K.K. Seth	(PDG Collab.)	REFID=49779
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)	REFID=49579
BAI	03B	PR D67 052002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49186
BAI	03C	PR D67 032004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49190
AUBERT	02B	PR D67 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48548
BAI	02	PR D65 052004	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48578
BAI	02B	PL B550 24	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49171
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
PDG	02	PR D66 010001	K. Hagiwara <i>et al.</i>	(PDG Collab.)	REFID=48632
BAI	01	PR D63 032002	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=48003
AMBROGIANI	00A	PR D62 032004	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)	REFID=47939
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
BAI	99C	PRL 83 1918	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47420
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
BAI	98F	PR D58 097101	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46340
BAI	98J	PRL 81 5080	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46554
ARMSTRONG	97	PR D55 1153	T.A. Armstrong <i>et al.</i>	(E760 Collab.)	REFID=45416
GRIBUSHIN	96	PR D53 4723	A. Gribushin <i>et al.</i>	(E672 and E706 Collab.)	REFID=44739
ARMSTRONG	93B	PR D47 772	T.A. Armstrong <i>et al.</i>	(FNAL E760 Collab.)	REFID=43307
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)	REFID=40345
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)	REFID=22012
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
FRANKLIN	83	Translated from YAF 41 733	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
EDWARDS	82C	PRL 51 963	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
OREGLIA	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22207
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
ZHOLENTZ	80	PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
Also		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BRANDELIK	79C	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
BRAUNSCH...	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22197
BURMESTER	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22198
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
BARTEL	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
TANENBAUM	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG	REFID=22194
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
ABRAMS	75	Stanford Symp. 25	G.S. Abrams	(LBL)	REFID=22176
ABRAMS	75B	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)	REFID=22177
BOYARSKI	75C	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)	REFID=22179
HILGER	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)	REFID=22186
LIBERMAN	75	Stanford Symp. 55	A.D. Liberman	(STAN)	REFID=22046
LUTH	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC	REFID=22188
WIIK	75	Stanford Symp. 69	B.H. Wiik	(DESY)	REFID=22050

$\psi(3770)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M053

 $\psi(3770)$ MASS (MeV)

NODE=M053M

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053M

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
3773.7±0.7 OUR FIT Error includes scale factor of 2.3. [3773.7 ± 0.4 MeV OUR 2023 FIT Scale factor = 1.4]

NODE=M053M

NEW

3778.1±0.7 OUR AVERAGE

3778.1±0.7±0.6		¹ AAIJ	19M	LHCB	$pp \rightarrow D\bar{D} + \text{anything}$
3779.2 ^{+1.8+0.6} _{-1.7-0.8}		² ANASHIN	12A	KEDR	$e^+e^- \rightarrow D\bar{D}$
3775.5±2.4±0.5	57	AUBERT	08B	BABR	$B \rightarrow D\bar{D}K$
3776 ±5 ±4	68	BRODZICKA	08	BELL	$B^+ \rightarrow D^0\bar{D}^0 K^+$
3778.8±1.9±0.9		AUBERT	07BE	BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3779.8±0.6		³ SHAMOV	17	RVUE	$e^+e^- \rightarrow D\bar{D}, \text{hadrons}$
3772.0±1.9		^{4,5} ABLIKIM	08D	BES2	$e^+e^- \rightarrow \text{hadrons}$
3778.4±3.0±1.3	34	CHISTOV	04	BELL	Sup. by BRODZICKA 08

¹ Measured in prompt hadroproduction.

² Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.

³ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.

⁴ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.

⁵ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

NODE=M053M;LINKAGE=B

NODE=M053M;LINKAGE=AN

NODE=M053M;LINKAGE=A

NODE=M053M;LINKAGE=AB

NODE=M053M;LINKAGE=NI

 $m_{\psi(3770)} = m_{\psi(2S)}$

NODE=M053DM

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

NODE=M053DM

VALUE (MeV) DOCUMENT ID TECN COMMENT
87.6±0.7 OUR FIT Error includes scale factor of 2.3. [87.6 ± 0.4 MeV OUR 2023 FIT Scale factor = 1.4]

NODE=M053DM

NEW

86.6±0.7 OUR AVERAGE Error includes scale factor of 2.0. See the ideogram below.

86.9±0.4		¹ ABLIKIM	07E	BES2	$e^+e^- \rightarrow \text{hadrons}$
86.7±0.7		ABLIKIM	06L	BES2	$e^+e^- \rightarrow \text{hadrons}$
80 ±2		SCHINDLER	80	MRK2	e^+e^-
86 ±2		² BACINO	78	DLCO	e^+e^-
88 ±3		RAPIDIS	77	LGW	e^+e^-

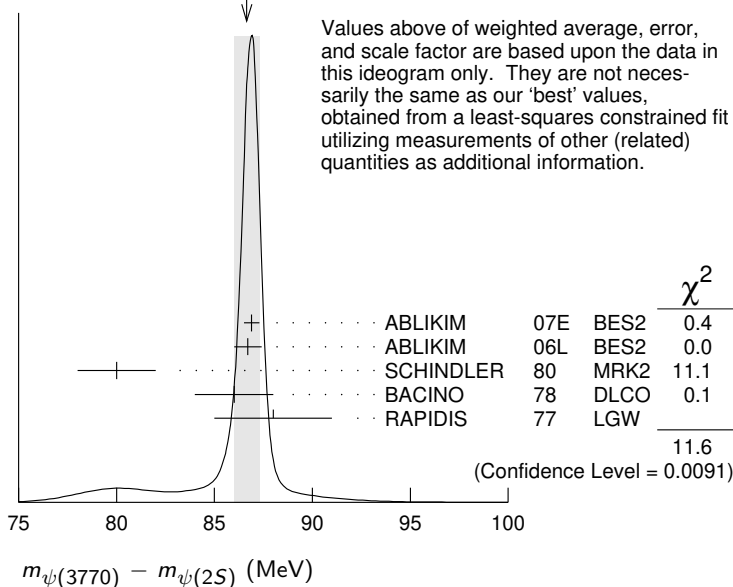
¹ BES-II $\psi(2S)$ mass subtracted (see ABLIKIM 06L).

² SPEAR $\psi(2S)$ mass subtracted (see SCHINDLER 80).

NODE=M053DM;LINKAGE=AK

NODE=M053DM;LINKAGE=S

WEIGHTED AVERAGE
86.6±0.7 (Error scaled by 2.0)



$\psi(3770)$ WIDTH

NODE=M053W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
27.2± 1.0 OUR FIT				
27.5± 0.9 OUR AVERAGE				
24.9 ⁺ ₋ 4.6 ⁺ ₋ 4.0 ⁻ ₋ 1.1		¹ ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
30.4± 8.5		^{2,3} ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
27 ±10 ±5	68	BRODZICKA	08 BELL	$B^+ \rightarrow D^0\bar{D}^0 K^+$
28.5± 1.2±0.2		³ ABLIKIM	07E BES2	$e^+e^- \rightarrow \text{hadrons}$
23.5± 3.7±0.9		AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
26.9± 2.4±0.3		³ ABLIKIM	06L BES2	$e^+e^- \rightarrow \text{hadrons}$
24 ± 5		³ SCHINDLER	80 MRK2	e^+e^-
24 ± 5		³ BACINO	78 DLCO	e^+e^-
28 ± 5		³ RAPIDIS	77 LGW	e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

25.8± 1.3 ⁴ SHAMOV 17 RVUE $e^+e^- \rightarrow D\bar{D}, \text{hadrons}$

¹ Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.

² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.

³ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.

⁴ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.

NODE=M053W;LINKAGE=AN

NODE=M053W;LINKAGE=AB

NODE=M053W;LINKAGE=NI

NODE=M053W;LINKAGE=A

$\psi(3770)$ DECAY MODES

NODE=M053220;NODE=M053

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $D\bar{D}$	(93 ⁺⁸ ₋₉) %	S=2.0
Γ_2 $D^0\bar{D}^0$	(52 ⁺⁴ ₋₅) %	S=2.0
Γ_3 D^+D^-	(41 ±4) %	S=2.0
Γ_4 $J/\psi X$	(5.0 ±2.2) × 10 ⁻³	
Γ_5 $J/\psi \pi^+\pi^-$	(1.93±0.28) × 10 ⁻³	
Γ_6 $J/\psi \pi^0\pi^0$	(8.0 ±3.0) × 10 ⁻⁴	
Γ_7 $J/\psi \eta$	(8.7 ±1.2) × 10 ⁻⁴	
Γ_8 $J/\psi \pi^0$	< 2.8 × 10 ⁻⁴	CL=90%
Γ_9 e^+e^-	(9.6 ±0.7) × 10 ⁻⁶	S=1.3

DESIG=2

DESIG=5

DESIG=6

DESIG=235

DESIG=4

DESIG=46

DESIG=47

DESIG=48

DESIG=1

Decays to light hadrons

NODE=M053;CLUMP=H

「10	$b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=20
「11	$\phi\eta'$	< 2.3	$\times 10^{-5}$	CL=90%	DESIG=17
「12	$\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%	DESIG=16
「13	$\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%	DESIG=15
「14	$\phi\eta$	$(3.1 \pm 0.7) \times 10^{-4}$			DESIG=8
「15	$\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=14
「16	$\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90%	DESIG=13
「17	$\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90%	DESIG=12
「18	$\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90%	DESIG=11
「19	$\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90%	DESIG=9
「20	$\rho\pi$	< 5	$\times 10^{-6}$	CL=90%	DESIG=10
「21	K^+K^-	not seen			DESIG=234;OUR EST;→ UNCHECKED ←
「22	$K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=19
「23	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=18
「24	$K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90%	DESIG=3
「25	$2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90%	DESIG=21
「26	$2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90%	DESIG=22
「27	$2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90%	DESIG=208
「28	$\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=24
「29	$3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$	CL=90%	DESIG=52
「30	$3(\pi^+\pi^-)\pi^0$	< 1.37	%	CL=90%	DESIG=55
「31	$3(\pi^+\pi^-)2\pi^0$	< 11.74	%	CL=90%	DESIG=210
「32	$\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90%	DESIG=23
「33	$\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90%	DESIG=206
「34	$\rho^0\pi^+\pi^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=64
「35	$\eta 3\pi$	< 1.34	$\times 10^{-3}$	CL=90%	DESIG=25
「36	$\eta 2(\pi^+\pi^-)$	< 2.43	%	CL=90%	DESIG=53
「37	$\eta\rho^0\pi^+\pi^-$	< 1.45	%	CL=90%	DESIG=221
「38	$\eta' 3\pi$	< 2.44	$\times 10^{-3}$	CL=90%	DESIG=26
「39	$K^+K^-\pi^+\pi^-$	< 9.0	$\times 10^{-4}$	CL=90%	DESIG=27
「40	$\phi\pi^+\pi^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=28
「41	$K^+K^-2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90%	DESIG=207
「42	$4(\pi^+\pi^-)$	< 1.67	%	CL=90%	DESIG=62
「43	$4(\pi^+\pi^-)\pi^0$	< 3.06	%	CL=90%	DESIG=63
「44	$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90%	DESIG=29
「45	$K^+K^-\pi^+\pi^-\pi^0$	< 2.36	$\times 10^{-3}$	CL=90%	DESIG=30
「46	$K^+K^-\rho^0\pi^0$	< 8	$\times 10^{-4}$	CL=90%	DESIG=67
「47	$K^+K^-\rho^+\pi^-$	< 1.46	%	CL=90%	DESIG=68
「48	ωK^+K^-	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=32
「49	$\phi\pi^+\pi^-\pi^0$	< 3.8	$\times 10^{-3}$	CL=90%	DESIG=69
「50	$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	< 1.62	%	CL=90%	DESIG=70
「51	$K^{*+}K^-\pi^+\pi^- + \text{c.c.}$	< 3.23	%	CL=90%	DESIG=71
「52	$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67	%	CL=90%	DESIG=209
「53	$K^+K^-2(\pi^+\pi^-)$	< 1.03	%	CL=90%	DESIG=57
「54	$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60	%	CL=90%	DESIG=58
「55	ηK^+K^-	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=31
「56	$\eta K^+K^-\pi^+\pi^-$	< 1.24	%	CL=90%	DESIG=222
「57	$\rho^0 K^+K^-$	< 5.0	$\times 10^{-3}$	CL=90%	DESIG=65
「58	$2(K^+K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=33
「59	ϕK^+K^-	< 7.5	$\times 10^{-4}$	CL=90%	DESIG=34
「60	$2(K^+K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=35
「61	$2(K^+K^-)\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
「62	$K_S^0 K^-\pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
「63	$K_S^0 K^-\pi^+\pi^0$	< 1.33	%	CL=90%	DESIG=201
「64	$K_S^0 K^-\rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
「65	$K_S^0 K^-2\pi^+\pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
「66	$K_S^0 K^-\pi^+\rho^0$	< 1.6	%	CL=90%	DESIG=215

Γ ₆₇	$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	DESIG=216
Γ ₆₈	$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	DESIG=203
Γ ₆₉	$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	DESIG=217
Γ ₇₀	$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	DESIG=204
Γ ₇₁	$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	DESIG=205
Γ ₇₂	$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
Γ ₇₃	$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	DESIG=219
Γ ₇₄	$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	DESIG=220
Γ ₇₅	$K_S^{*0} K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
Γ ₇₆	$p\bar{p}$	not seen			DESIG=233;OUR EST;→ UNCHECKED ←
Γ ₇₇	$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=54
Γ ₇₈	$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
Γ ₇₉	$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
Γ ₈₀	$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
Γ ₈₁	$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
Γ ₈₂	$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	DESIG=72
Γ ₈₃	$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
Γ ₈₄	$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
Γ ₈₅	$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
Γ ₈₆	$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
Γ ₈₇	$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
Γ ₈₈	$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224
Γ ₈₉	$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Γ ₉₀	$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Γ ₉₁	$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Γ ₉₂	$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Γ ₉₃	$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45
Γ ₉₄	$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	DESIG=226
Γ ₉₅	$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=227
Γ ₉₆	$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=228
Γ ₉₇	$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=229
Γ ₉₈	$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	DESIG=230
Γ ₉₉	$\Xi^- \bar{\Xi}^+$	$(1.4 \pm 0.4) \times 10^{-4}$			DESIG=236
Radiative decays					
Γ ₁₀₀	$\gamma\chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	DESIG=51
Γ ₁₀₁	$\gamma\chi_{c1}$	$(2.49 \pm 0.23) \times 10^{-3}$			DESIG=50
Γ ₁₀₂	$\gamma\chi_{c0}$	$(6.9 \pm 0.6) \times 10^{-3}$			DESIG=49
Γ ₁₀₃	$\gamma\eta_c$	< 7	$\times 10^{-4}$	CL=90%	DESIG=231
Γ ₁₀₄	$\gamma\eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	DESIG=232
Γ ₁₀₅	$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Γ ₁₀₆	$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Γ ₁₀₇	$\gamma\pi^0$	< 2	$\times 10^{-4}$	CL=90%	DESIG=211

CONSTRAINED FIT INFORMATION

An overall fit to the total width, a partial width, and 3 branching ratios uses 23 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 20.1$ for 19 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_3	99		
x_9	0	0	
Γ	0	0	-44
	x_2	x_3	x_9

	Mode	Rate (MeV)	Scale factor	
Γ ₂	$D^0 \bar{D}^0$	14.0 ± 1.4	1.8	DESIG=5
Γ ₃	$D^+ D^-$	11.2 ± 1.1	1.7	DESIG=6
Γ ₉	$e^+ e^-$	$(2.62 \pm 0.18) \times 10^{-4}$	1.4	DESIG=1

$\psi(3770)$ PARTIAL WIDTHS

NODE=M053225

 $\Gamma(e^+e^-)$ Γ_9

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.262±0.018 OUR FIT	Error includes scale factor of 1.4.			
0.256±0.016 OUR AVERAGE	Error includes scale factor of 1.2.			
0.154 ^{+0.079+0.021} _{-0.058-0.027}	1,2	ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
0.22 ± 0.05	3,4	ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
0.277±0.011±0.013	4	ABLIKIM	07E BES2	$e^+e^- \rightarrow$ hadrons
0.203±0.003 ^{+0.041} _{-0.027}	1.4M 4,5	BESSON	06 CLEO	$e^+e^- \rightarrow$ hadrons
0.276±0.050	4	SCHINDLER	80 MRK2	e^+e^-
0.18 ± 0.06	4	BACINO	78 DLCO	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.196±0.018	6	SHAMOV	17 RVUE	$e^+e^- \rightarrow D\bar{D}$, hadrons
0.414 ^{+0.072+0.093} _{-0.080-0.028}	2,7	ANASHIN	12A KEDR	$e^+e^- \rightarrow D\bar{D}$
0.37 ± 0.09	8	RAPIDIS	77 LGW	e^+e^-

NODE=M053W1
NODE=M053W1

OCCUR=2

OCCUR=2

¹ Solution I of the two solutions.² Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.³ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = 0^\circ$.⁴ Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.⁵ BESSON 06 (as corrected in BESSON 10) measure $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb at $\sqrt{s} = 3773 \pm 1$ MeV, and obtain Γ_{ee} from the Born-level cross section calculated using $\psi(3770)$ mass and width from our 2004 edition, PDG 04.⁶ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.⁷ Solution II of the two solutions.⁸ See also $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ below.NODE=M053W1;LINKAGE=A1
NODE=M053W1;LINKAGE=AN
NODE=M053W1;LINKAGE=AB

NODE=M053W1;LINKAGE=NI

NODE=M053W1;LINKAGE=BE

NODE=M053W1;LINKAGE=B

NODE=M053W1;LINKAGE=A2

NODE=M053W1;LINKAGE=R

 $\psi(3770) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M053235

 $\Gamma(\Xi^- \Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{99}\Gamma_9/\Gamma$

VALUE (10^{-2} eV)	DOCUMENT ID	TECN	COMMENT
3.55±0.92	1	ABLIKIM	23BK BES3 $e^+e^- \rightarrow \psi(3770)$

¹ From a fit to $e^+e^- \rightarrow \Xi^- \Xi^+$ cross sections. Signal significance is 4.5σ .NODE=M053P01
NODE=M053P01

NODE=M053P01;LINKAGE=A

 $\psi(3770)$ BRANCHING RATIOS

NODE=M053230

 $\Gamma(D\bar{D})/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma = (\Gamma_2+\Gamma_3)/\Gamma$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.93^{+0.08}_{-0.09} OUR FIT	Error includes scale factor of 2.0.			
0.93^{+0.08}_{-0.09} OUR AVERAGE	Error includes scale factor of 2.1.			
0.849±0.056±0.018	1	ABLIKIM	08B BES2	$e^+e^- \rightarrow \text{non-}D\bar{D}$
1.033±0.014 ^{+0.048} _{-0.066}	1.427M 2	BESSON	06 CLEO	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.836±0.049	3	SHAMOV	17 RVUE	$e^+e^- \rightarrow D\bar{D}$, hadrons
0.866±0.050±0.036	4,5	ABLIKIM	07K BES2	$e^+e^- \rightarrow \text{non-}D\bar{D}$
0.836±0.073±0.042	5	ABLIKIM	06L BES2	$e^+e^- \rightarrow D\bar{D}$
0.855±0.017±0.058	5,6	ABLIKIM	06N BES2	$e^+e^- \rightarrow D\bar{D}$

¹ Neglecting interference.² Obtained by comparing a measurement of the total cross section (corrected in BESSON 10) with that of $D\bar{D}$ reported by CLEO in DOBBS 07.³ From the joint analysis of the data on the $D\bar{D}$ and inclusive hadronic cross sections in the $\psi(3770)$ region from BaBar, Belle, BES-II, CLEO and KEDR.⁴ Using $\sigma^{obs} = 7.07 \pm 0.58$ nb and neglecting interference.⁵ Not independent of ABLIKIM 08B.⁶ From a measurement of $\sigma(e^+e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.NODE=M053R1
NODE=M053R1NODE=M053R1;LINKAGE=AI
NODE=M053R1;LINKAGE=BE

NODE=M053R1;LINKAGE=A

NODE=M053R1;LINKAGE=AL
NODE=M053R1;LINKAGE=SU
NODE=M053R1;LINKAGE=AB

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R46
NODE=M053R46

0.52 $^{+0.04}_{-0.05}$ OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.467 $\pm 0.047 \pm 0.023$	ABLIKIM	06L	BES2	$e^+e^- \rightarrow D^0\bar{D}^0$
0.499 $\pm 0.013 \pm 0.038$	¹ ABLIKIM	06N	BES2	$e^+e^- \rightarrow D^0\bar{D}^0$

¹ From a measurement of $\sigma(e^+e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.

NODE=M053R46;LINKAGE=AB

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

NODE=M053R47
NODE=M053R47

0.41 ± 0.04 OUR FIT Error includes scale factor of 2.0.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.369 $\pm 0.037 \pm 0.028$	ABLIKIM	06L	BES2	$e^+e^- \rightarrow D^+D^-$
0.357 $\pm 0.011 \pm 0.034$	¹ ABLIKIM	06N	BES2	$e^+e^- \rightarrow D^+D^-$

¹ From a measurement of $\sigma(e^+e^- \rightarrow D\bar{D})$ at $\sqrt{s} = 3773$ MeV, using the $\psi(3770)$ resonance parameters measured by ABLIKIM 06L.

NODE=M053R47;LINKAGE=AB

 $\Gamma(D^0\bar{D}^0)/\Gamma(D^+D^-)$ Γ_2/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R5
NODE=M053R5

1.253 ± 0.016 OUR FIT

1.253 ± 0.016 OUR AVERAGE

1.252 $\pm 0.009 \pm 0.013$	5.3M	BONVICINI	14	CLEO	$e^+e^- \rightarrow D\bar{D}$
1.39 $\pm 0.31 \pm 0.12$		PAKHLOVA	08	BELL	10.6 $e^+e^- \rightarrow D\bar{D}\gamma$
1.78 $\pm 0.33 \pm 0.24$		AUBERT	07BE	BABR	$e^+e^- \rightarrow D\bar{D}\gamma$
1.27 $\pm 0.12 \pm 0.08$		ABLIKIM	06L	BES2	$e^+e^- \rightarrow D\bar{D}$
2.43 $\pm 1.50 \pm 0.43$	34	¹ CHISTOV	04	BELL	$B^+ \rightarrow \psi(3770)K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.258 $\pm 0.016 \pm 0.014$		² DOBBS	07	CLEO	$e^+e^- \rightarrow D\bar{D}$

¹ See ADLER 88C for older measurements of this quantity.

² Superseded by BONVICINI 14.

NODE=M053R5;LINKAGE=CH
NODE=M053R5;LINKAGE=DO

 $\Gamma(J/\psi X)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT

NODE=M053P00
NODE=M053P00

0.5 $\pm 0.2 \pm 0.1$

¹ ABLIKIM	21Z	BES3	$e^+e^- \rightarrow \ell^+\ell^-X$

¹ From a fit to the $e^+e^- \rightarrow J/\psi X$ cross section between 3.645 and 3.891 GeV, with $\psi(2S)$ and $\psi(3770)$ masses, total widths and leptonic widths fixed to the values from the PDG 20. An alternative fit with an improved χ^2 , corresponding to a significance of 5.3 σ , uses an additional resonance with a mass of $3766.2 \pm 3.8 \pm 0.4$ MeV/ c^2 , a total width of $22.2 \pm 5.9 \pm 1.4$ MeV, and $\Gamma(e^+e^-)B(J/\psi X) = 79.4 \pm 85.5 \pm 11.7$ eV, possibly compatible with the results of ABLIKIM 08H.

NODE=M053P00;LINKAGE=A

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R4
NODE=M053R4

1.93 ± 0.28 OUR AVERAGE

1.89 $\pm 0.20 \pm 0.20$	231 ± 33	ADAM	06	CLEO	$e^+e^- \rightarrow \psi(3770)$
3.4 $\pm 1.4 \pm 0.9$	17.8 ± 4.8	BAI	05	BES2	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R7
NODE=M053R7

0.080 $\pm 0.025 \pm 0.016$	39 ± 14	ADAM	06	CLEO	$e^+e^- \rightarrow \psi(3770)$

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R8
NODE=M053R8

8.7 ± 1.2 OUR AVERAGE

[(90 ± 40) $\times 10^{-5}$ OUR 2023 AVERAGE]

8.7 $\pm 1.0 \pm 0.8$	232 ± 23	¹ ABLIKIM	23v	BES3	$e^+e^- \rightarrow \psi(3770)$
8.7 $\pm 3.3 \pm 2.2$	22 ± 10	ADAM	06	CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Incoherent fit. Alternate fits that include interference with background yield results between (11.2 $\pm 5.8 \pm 1.1$) $\times 10^{-4}$ and (11.6 $\pm 6.0 \pm 1.1$) $\times 10^{-4}$.

NODE=M053R8;LINKAGE=A

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M053R9
NODE=M053R9

<28	90	<10	ADAM	06	CLEO	$e^+e^- \rightarrow \psi(3770)$

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_9/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

0.96±0.07 OUR FIT Error includes scale factor of 1.3.**1.3 ±0.2**

RAPIDIS

77

LGW

 e^+e^- NODE=M053R2
NODE=M053R2

————— DECAYS TO LIGHT HADRONS —————

 $\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$ Γ_{10}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<1.4

90

¹

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053250

NODE=M053R82
NODE=M053R82

NODE=M053R82;LINKAGE=AD

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<2.3 × 10⁻⁵ (CL = 90%) [$<7 \times 10^{-4}$ (CL = 90%) OUR 2023 BEST LIMIT]**<2.3 × 10⁻⁵**

90

¹

ABLIKIM

23BC

BES3

 $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

 $<7 \times 10^{-4}$

90

²

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ ABLIKIM 23BC fit to $e^+e^- \rightarrow \phi\eta'$ cross sections between 3.508 and 4.951 GeV considering interference between continuum and $\psi(3770)$ amplitudes.² ADAMS 06 compare cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.NODE=M053R83
NODE=M053R83

NODE=M053R83;LINKAGE=A

NODE=M053R83;LINKAGE=AD

 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$ Γ_{12}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<4

90

¹

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.NODE=M053R84
NODE=M053R84

NODE=M053R84;LINKAGE=AD

 $\Gamma(\rho^0\eta')/\Gamma_{\text{total}}$ Γ_{13}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<6

90

¹

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.NODE=M053R85
NODE=M053R85

NODE=M053R85;LINKAGE=AD

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{14}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

3.1±0.6±0.3¹

ADAMS

06

CLEO

 $3.773 e^+e^- \rightarrow \phi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19

90

²

ABLIKIM

07B

BES2

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.NODE=M053R6
NODE=M053R6

NODE=M053R6;LINKAGE=AD

NODE=M053R6;LINKAGE=AK

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<1.4

90

¹

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.NODE=M053R86
NODE=M053R86

NODE=M053R86;LINKAGE=AD

 $\Gamma(\rho^0\eta)/\Gamma_{\text{total}}$ Γ_{16}/Γ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

<5

90

¹

ADAMS

06

CLEO

 $e^+e^- \rightarrow \psi(3770)$ ¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.NODE=M053R87
NODE=M053R87

NODE=M053R87;LINKAGE=AD

$\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<50	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R11
NODE=M053R11

NODE=M053R11;LINKAGE=AD

NODE=M053R11;LINKAGE=AK

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R88
NODE=M053R88

NODE=M053R88;LINKAGE=AD

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	^{1,2} ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Data suggest possible destructive interference with continuum.

² Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R89
NODE=M053R89

NODE=M053R89;LINKAGE=AD

NODE=M053R89;LINKAGE=AS

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	^{1,2} ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

² Data suggest possible destructive interference with continuum.

NODE=M053R90
NODE=M053R90

NODE=M053R90;LINKAGE=AD

NODE=M053R90;LINKAGE=AS

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$\sim 10^{-5}$ ¹ DRUZHININ 15 RVUE $e^+e^- \rightarrow \psi(3770)$

¹ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0 K_L^0$.

NODE=M053R00
NODE=M053R00

NODE=M053R00;LINKAGE=A

 $\Gamma(K^*(892)^+K^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R91
NODE=M053R91

NODE=M053R91;LINKAGE=AS

 $\Gamma(K^*(892)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ ADAMS	06 CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Comparing cross sections at $\sqrt{s} = 3.773$ GeV and $\sqrt{s} = 3.671$ GeV, neglecting interference, and using $\sigma(\psi(3770) \rightarrow D\bar{D}) = 6.39 \pm 0.20$ nb.

NODE=M053R92
NODE=M053R92

NODE=M053R92;LINKAGE=AD

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	¹ CRONIN-HEN..06	CLEO	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21 90 ² ABLIKIM 04F BES $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = (6.38 \pm 0.08^{+0.41}_{-0.30})$ nb from BESSON 06 and $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6895 \pm 0.0014$.

² Using $B(K_S^0 \rightarrow \pi^+\pi^-) = 0.6860 \pm 0.0027$.

NODE=M053R3
NODE=M053R3

NODE=M053R3;LINKAGE=CR

NODE=M053R3;LINKAGE=AB

$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11.2	90	¹ HUANG 06A CLEO		$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<48	90	² ABLIKIM 07B BES2		$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R21
 NODE=M053R21

NODE=M053R21;LINKAGE=HU
 NODE=M053R21;LINKAGE=AK

 $\Gamma(2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10.6	90	¹ HUANG 06A CLEO		$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<62	90	² ABLIKIM 07B BES2		$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R22
 NODE=M053R22

NODE=M053R22;LINKAGE=HU
 NODE=M053R22;LINKAGE=AK

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<58.5	90	305	ABLIKIM 08N BES2		$e^+e^- \rightarrow \psi(3770)$

NODE=M053R72
 NODE=M053R72

 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	¹ HUANG 06A CLEO		$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<55	90	² ABLIKIM 07I BES2		$3.77 e^+e^-$
¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R24
 NODE=M053R24

NODE=M053R24;LINKAGE=HU
 NODE=M053R24;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<91	90	¹ ABLIKIM 07B BES2		$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R07
 NODE=M053R07

NODE=M053R07;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<137	90	¹ ABLIKIM 07B BES2		$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R10
 NODE=M053R10

NODE=M053R10;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<117.4	90	59	ABLIKIM 08N BES2		$e^+e^- \rightarrow \psi(3770)$

NODE=M053R74
 NODE=M053R74

 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	¹ HUANG 06A CLEO		$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<2.3	90	² ABLIKIM 10D BES2		$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R23
 NODE=M053R23

NODE=M053R23;LINKAGE=HU
 NODE=M053R23;LINKAGE=AK

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8.9	90	218	ABLIKIM 08N BES2		$e^+e^- \rightarrow \psi(3770)$

NODE=M053R70
 NODE=M053R70

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R53
NODE=M053R53

NODE=M053R53;LINKAGE=AK

 $\Gamma(\eta 3\pi)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<13.4	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R25
NODE=M053R25

NODE=M053R25;LINKAGE=HU

 $\Gamma(\eta 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<243	90	¹ ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R08
NODE=M053R08

NODE=M053R08;LINKAGE=AK

 $\Gamma(\eta \rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	¹ ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R77
NODE=M053R77

NODE=M053R77;LINKAGE=AK

 $\Gamma(\eta' 3\pi)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<24.4	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R26
NODE=M053R26

NODE=M053R26;LINKAGE=HU

 $\Gamma(K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 9.0	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<48	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R27
NODE=M053R27

NODE=M053R27;LINKAGE=HU
NODE=M053R27;LINKAGE=AK

 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R28
NODE=M053R28

NODE=M053R28;LINKAGE=HU
NODE=M053R28;LINKAGE=AK

 $\Gamma(K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4.2	90	14	ABLIKIM	08N BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R71
NODE=M053R71

 $\Gamma(4(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<16.7	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R50
NODE=M053R50

NODE=M053R50;LINKAGE=AK

 $\Gamma(4(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<30.6	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R52
NODE=M053R52

NODE=M053R52;LINKAGE=AK

$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4.5	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

NODE=M053R29
NODE=M053R29

NODE=M053R29;LINKAGE=HU

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 23.6	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<111	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R30
NODE=M053R30

NODE=M053R30;LINKAGE=HU
NODE=M053R30;LINKAGE=AK

 $\Gamma(K^+K^-\rho^0\pi^0)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	¹ ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R58
NODE=M053R58

NODE=M053R58;LINKAGE=AK

 $\Gamma(K^+K^-\rho^+\pi^-)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<146	90	¹ ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R59
NODE=M053R59

NODE=M053R59;LINKAGE=AK

 $\Gamma(\omega K^+K^-)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.4	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<66	90	² ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Using $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R32
NODE=M053R32

NODE=M053R32;LINKAGE=HU
NODE=M053R32;LINKAGE=AK

 $\Gamma(\phi\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<38	90	¹ ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R60
NODE=M053R60

NODE=M053R60;LINKAGE=AK

 $\Gamma(K^{*0}K^-\pi^+\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<162	90	¹ ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R61
NODE=M053R61

NODE=M053R61;LINKAGE=AK

 $\Gamma(K^{*+}K^-\pi^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<323	90	¹ ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R62
NODE=M053R62

NODE=M053R62;LINKAGE=AK

 $\Gamma(K^+K^-\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<26.7	90	24	ABLIKIM	08N BES2	$e^+e^- \rightarrow \psi(3770)$

NODE=M053R73
NODE=M053R73

 $\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<10.3	90	¹ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R57
NODE=M053R57

NODE=M053R57;LINKAGE=AK

$\Gamma(K^+ K^- 2(\pi^+ \pi^-) \pi^0) / \Gamma_{\text{total}}$ Γ_{54} / Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<36.0	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R51
NODE=M053R51

NODE=M053R51;LINKAGE=AK

 $\Gamma(\eta K^+ K^-) / \Gamma_{\text{total}}$ Γ_{55} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.1	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<31	90	² ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R31
NODE=M053R31

NODE=M053R31;LINKAGE=HU
NODE=M053R31;LINKAGE=AK

 $\Gamma(\eta K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{56} / Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.24	90	¹ ABLIKIM	10D BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R78
NODE=M053R78

NODE=M053R78;LINKAGE=AK

 $\Gamma(\rho^0 K^+ K^-) / \Gamma_{\text{total}}$ Γ_{57} / Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5.0	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R54
NODE=M053R54

NODE=M053R54;LINKAGE=AK

 $\Gamma(2(K^+ K^-)) / \Gamma_{\text{total}}$ Γ_{58} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.0	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<17	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R33
NODE=M053R33

NODE=M053R33;LINKAGE=HU
NODE=M053R33;LINKAGE=AK

 $\Gamma(\phi K^+ K^-) / \Gamma_{\text{total}}$ Γ_{59} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<24	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R34
NODE=M053R34

NODE=M053R34;LINKAGE=HU
NODE=M053R34;LINKAGE=AK

 $\Gamma(2(K^+ K^-) \pi^0) / \Gamma_{\text{total}}$ Γ_{60} / Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.9	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<46	90	² ABLIKIM	07B BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R35
NODE=M053R35

NODE=M053R35;LINKAGE=HU
NODE=M053R35;LINKAGE=AK

 $\Gamma(2(K^+ K^-) \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{61} / Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R48
NODE=M053R48

NODE=M053R48;LINKAGE=AK

$$\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<3.2	90	18

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{62}/\Gamma$$

NODE=M053R64
NODE=M053R64

$$\Gamma(K_S^0 K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<13.3	90	40

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{63}/\Gamma$$

NODE=M053R65
NODE=M053R65

$$\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<6.6	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{64}/\Gamma$$

NODE=M053R15
NODE=M053R15

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<8.7	90	39

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{65}/\Gamma$$

NODE=M053R66
NODE=M053R66

$$\Gamma(K_S^0 K^- \pi^+ \rho^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<1.6	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{66}/\Gamma$$

NODE=M053R16
NODE=M053R16

$$\Gamma(K_S^0 K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<1.3	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{67}/\Gamma$$

NODE=M053R17
NODE=M053R17

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<41.8	90	23

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{68}/\Gamma$$

NODE=M053R67
NODE=M053R67

$$\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<4.8	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{69}/\Gamma$$

NODE=M053R18
NODE=M053R18

$$\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<12.2	90	4

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{70}/\Gamma$$

NODE=M053R68
NODE=M053R68

$$\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	EVTs
<26.5	90	17

DOCUMENT ID	TECN	COMMENT
ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{71}/\Gamma$$

NODE=M053R69
NODE=M053R69

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<4.9	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{72}/\Gamma$$

NODE=M053R19
NODE=M053R19

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<3.0	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{73}/\Gamma$$

NODE=M053R75
NODE=M053R75

$$\Gamma(K_S^0 K^- K^+ K^- \pi^+ \eta)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	CL%
<2.2	90

DOCUMENT ID	TECN	COMMENT
ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{74}/\Gamma$$

NODE=M053R76
NODE=M053R76

$$\Gamma(K^{*0} K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%
<9.7	90

DOCUMENT ID	TECN	COMMENT
¹ ABLIKIM 07F BES2		$e^+ e^- \rightarrow \psi(3770)$

$$\Gamma_{75}/\Gamma$$

NODE=M053R55
NODE=M053R55

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R55;LINKAGE=AK

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen ¹ AAIJ 17AD LHCb $pp \rightarrow B^+ X \rightarrow p\bar{p}K^+ X$

$7.1^{+8.6}_{-2.9}$ 684 ² ABLIKIM 14L BES3 $e^+e^- \rightarrow \psi(3770)$

310 ± 30 684 ³ ABLIKIM 14L BES3 $e^+e^- \rightarrow \psi(3770)$

¹ AAIJ 17AD reports $B(B^+ \rightarrow \psi(3770)K^+ \rightarrow p\bar{p}K^+)/B(B^+ \rightarrow J/\psi K^+ \rightarrow p\bar{p}K^+) < 0.09$ (0.10) at 90% (95%) CL.

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

NODE=M053R98
NODE=M053R98

OCCUR=2

NODE=M053R98;LINKAGE=C

NODE=M053R98;LINKAGE=A

NODE=M053R98;LINKAGE=B

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 0.4 90 ^{1,2} ABLIKIM 14O BES3 $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

59 $^{+3}_{-2} \pm 5$ ^{1,3} ABLIKIM 14O BES3 $e^+e^- \rightarrow \psi(3770)$

<12 90 ⁴ ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Calculated by the authors using $\sigma(e^+e^- \rightarrow \psi(3770) \rightarrow \text{hadrons}) = 6.36 \pm 0.08^{+0.41}_{-0.30}$ nb from BESSON 10.

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

⁴ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R09
NODE=M053R09

OCCUR=2

NODE=M053R09;LINKAGE=A

NODE=M053R09;LINKAGE=B

NODE=M053R09;LINKAGE=C

NODE=M053R09;LINKAGE=AK

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 5.8 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<16 90 ² ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R36
NODE=M053R36

NODE=M053R36;LINKAGE=HU

NODE=M053R36;LINKAGE=AK

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1.2×10^{-4} 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 1.8×10^{-4} 90 ² ABLIKIM 21AS BES3 $e^+e^- \rightarrow \psi(3770)$

< 4×10^{-4} 90 ³ ABLIKIM 07F BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV. At a 90% CL the lower bound is $> 2.4 \times 10^{-6}$.

³ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R42
NODE=M053R42

NODE=M053R42;LINKAGE=HU

NODE=M053R42;LINKAGE=A

NODE=M053R42;LINKAGE=AK

 $\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 18.5 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<73 90 ² ABLIKIM 07B BES2 $e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R37
NODE=M053R37

NODE=M053R37;LINKAGE=HU

NODE=M053R37;LINKAGE=AK

 $\Gamma(\omega p\bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

< 2.9 90 ¹ HUANG 06A CLEO $e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30 90 ² ABLIKIM 07I BES2 $3.77 e^+e^-$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Using $\sigma^{obs} = 7.15 \pm 0.27 \pm 0.27$ nb and neglecting interference.

NODE=M053R39
NODE=M053R39

NODE=M053R39;LINKAGE=HU

NODE=M053R39;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.7	90	¹ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<12	90	² ABLIKIM	07I BES2	$3.77 e^+e^-$

¹ Assuming that interference effects between resonance and continuum can be neglected.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R63
NODE=M053R63

NODE=M053R63;LINKAGE=A
NODE=M053R63;LINKAGE=AK

 $\Gamma(\rho\bar{\rho}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	¹ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R49
NODE=M053R49

NODE=M053R49;LINKAGE=AK

 $\Gamma(\eta\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.4	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11	90	² ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R38
NODE=M053R38

NODE=M053R38;LINKAGE=HU
NODE=M053R38;LINKAGE=AK

 $\Gamma(\eta\rho\bar{\rho}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3.3	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R79
NODE=M053R79

NODE=M053R79;LINKAGE=AK

 $\Gamma(\rho^0\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	¹ ABLIKIM	07F BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R56
NODE=M053R56

NODE=M053R56;LINKAGE=AK

 $\Gamma(\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.2	90	¹ HUANG	06A CLEO	$e^+e^- \rightarrow \psi(3770)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11	90	² ABLIKIM	07B BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R40
NODE=M053R40

NODE=M053R40;LINKAGE=HU
NODE=M053R40;LINKAGE=AK

 $\Gamma(\eta\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.9	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R80
NODE=M053R80

NODE=M053R80;LINKAGE=AK

 $\Gamma(\pi^0\rho\bar{\rho}K^+K^-)/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ ABLIKIM	10D BES2	$e^+e^- \rightarrow \psi(3770)$

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R81
NODE=M053R81

NODE=M053R81;LINKAGE=AK

$\Gamma(\phi\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹ HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<9	90	² ABLIKIM 07B	BES2	$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R41
 NODE=M053R41

NODE=M053R41;LINKAGE=HU
 NODE=M053R41;LINKAGE=AK

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.5	90	¹ HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.7	90	² ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
<39	90	³ ABLIKIM 07F	BES2	$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				
² Assuming that interference effects between resonance and continuum can be neglected.				
³ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R43
 NODE=M053R43

NODE=M053R43;LINKAGE=HU
 NODE=M053R43;LINKAGE=A
 NODE=M053R43;LINKAGE=AK

 $\Gamma(\Lambda\bar{\rho}K^+)/\Gamma_{\text{total}}$ Γ_{92}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.8	90	¹ HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				

NODE=M053R44
 NODE=M053R44

NODE=M053R44;LINKAGE=HU

 $\Gamma(\Lambda\bar{\rho}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6.3	90	¹ HUANG 06A	CLEO	$e^+e^- \rightarrow \psi(3770)$
¹ Using $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ nb at the resonance.				

NODE=M053R45
 NODE=M053R45

NODE=M053R45;LINKAGE=HU

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	¹ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected.				

NODE=M053R93
 NODE=M053R93

NODE=M053R93;LINKAGE=A

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected.				

NODE=M053R94
 NODE=M053R94

NODE=M053R94;LINKAGE=A

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	¹ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected.				

NODE=M053R95
 NODE=M053R95

NODE=M053R95;LINKAGE=A

 $\Gamma(\Xi^+\bar{\Xi}^-)/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	¹ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected.				

NODE=M053R96
 NODE=M053R96

NODE=M053R96;LINKAGE=A

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(3770)$
¹ Assuming that interference effects between resonance and continuum can be neglected.				

NODE=M053R97
 NODE=M053R97

NODE=M053R97;LINKAGE=A

RADIATIVE DECAYS

NODE=M053240

$\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$					Γ_{100}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
<0.64	90	¹ ABLIKIM	15J BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.0	90	² BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$	
<0.9	90	³ COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	

¹ This limit is equivalent to $(0.25 \pm 0.21 \pm 0.18) \times 10^{-3}$ branching fraction value.

² Uses $B(\psi(2S) \rightarrow \gamma\chi_{c2}) = 9.22 \pm 0.11 \pm 0.46\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

³ Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R03
NODE=M053R03NODE=M053R03;LINKAGE=A
NODE=M053R03;LINKAGE=BR

NODE=M053R03;LINKAGE=CO

$\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$					Γ_{101}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
2.49±0.23 OUR AVERAGE					
2.0 ±0.8 ±0.1	202	¹ ABLIKIM	16B BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$	
2.48±0.15±0.23	0.6k	ABLIKIM	15J BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	
2.4 ±0.8 ±0.2		² ABLIKIM	14H BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow K_S^0 K^\pm \pi^\mp$	
2.9 ±0.5 ±0.4		³ BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}, \gamma\gamma J/\psi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.9 ±1.4 ±0.6	54	⁴ BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$	
2.8 ±0.5 ±0.4	53	⁵ COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	

NODE=M053R02
NODE=M053R02

OCCUR=2

¹ ABLIKIM 16B reports $(1.94 \pm 0.42 \pm 0.64) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.27) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)] = (8.51 \pm 2.39 \pm 1.42) \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp) = 0.00349 \pm 0.00031$. Our first error is their experiment's error and our second error is the systematic error from using our best value. We have calculated the best value of $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/2 of $B(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) = (7.0 \pm 0.6) \times 10^{-3}$.

³ Averages the two measurements from COAN 06A and BRIERE 06.

⁴ Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = 9.07 \pm 0.11 \pm 0.54\%$ from ATHAR 04, $\psi(2S)$ mass and width from PDG 04, and $\Gamma_{ee}(\psi(2S)) = 2.54 \pm 0.03 \pm 0.11$ keV from ADAM 06.

⁵ Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R02;LINKAGE=A

NODE=M053R02;LINKAGE=AB

NODE=M053R02;LINKAGE=BI
NODE=M053R02;LINKAGE=BR

NODE=M053R02;LINKAGE=CO

$\Gamma(\gamma\chi_{c1})/\Gamma(J/\psi\pi^+\pi^-)$					Γ_{101}/Γ_5
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
1.49±0.31±0.26	53 ± 10	¹ COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	

¹ Using $B(\psi(3770) \rightarrow J/\psi\pi^+\pi^-) = (1.89 \pm 0.20 \pm 0.20) \times 10^{-3}$ from ADAM 06.

NODE=M053R04
NODE=M053R04

NODE=M053R04;LINKAGE=CO

$\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$					Γ_{102}/Γ
VALUE (units 10^{-3})	CL% EVTS	DOCUMENT ID	TECN	COMMENT	
6.9±0.6 OUR AVERAGE					
6.7±0.7±0.2	2.2k	¹ ABLIKIM	16B BES3	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$	
7.3±0.7±0.6	274	BRIERE	06 CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma + \text{hadrons}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 44	90	² COAN	06A CLEO	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$	

NODE=M053R01
NODE=M053R01

- ¹ ABLIKIM 16B reports $(6.88 \pm 0.28 \pm 0.67) \times 10^{-3}$ from a measurement of $[\Gamma(\psi(3770) \rightarrow \gamma \chi_{c0})/\Gamma_{\text{total}}] / [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.99 \pm 0.27) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.77 \pm 0.23) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² Using $\Gamma_{ee}(\psi(2S)) = (2.54 \pm 0.03 \pm 0.11)$ keV from ADAM 06 and taking $\sigma(e^+e^- \rightarrow D\bar{D})$ from HE 05 for $\sigma(e^+e^- \rightarrow \psi(3770))$.

NODE=M053R01;LINKAGE=B

NODE=M053R01;LINKAGE=CO

 $\Gamma(\gamma \chi_{c0})/\Gamma(\gamma \chi_{c2})$ **$\Gamma_{102}/\Gamma_{100}$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

>8	90	¹ BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

¹ Not independent of other results in BRIERE 06.NODE=M053R06
NODE=M053R06

NODE=M053R06;LINKAGE=BR

 $\Gamma(\gamma \chi_{c0})/\Gamma(\gamma \chi_{c1})$ **$\Gamma_{102}/\Gamma_{101}$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.5 ± 0.6		¹ BRIERE	06	CLEO $e^+e^- \rightarrow \psi(3770)$

¹ Not independent of other results in BRIERE 06.NODE=M053R05
NODE=M053R05

NODE=M053R05;LINKAGE=BR

 $\Gamma(\gamma \eta_c)/\Gamma_{\text{total}}$ **Γ_{103}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<7 \times 10^{-4}$	90	¹ ABLIKIM	14H	BES3

¹ ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma \eta_c)/\Gamma_{\text{total}}] \times [B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 16 \times 10^{-6}$ which we divide by our best value $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = 2.38 \times 10^{-2}$. We have calculated the best value of $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(1S) \rightarrow K \bar{K} \pi) = 7.1 \times 10^{-2}$.

NODE=M053R99
NODE=M053R99

NODE=M053R99;LINKAGE=AB

 $\Gamma(\gamma \eta_c(2S))/\Gamma_{\text{total}}$ **Γ_{104}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<9 \times 10^{-4}$	90	¹ ABLIKIM	14H	BES3

¹ ABLIKIM 14H reports $[\Gamma(\psi(3770) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}] \times [B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)] < 5.6 \times 10^{-6}$ which we divide by our best value $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp) = 6 \times 10^{-3}$. We have calculated the best value of $B(\eta_c(2S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(2S) \rightarrow K \bar{K} \pi) = 1.9 \times 10^{-2}$.

NODE=M053R20
NODE=M053R20

NODE=M053R20;LINKAGE=AB

 $\Gamma(\gamma \eta')/\Gamma_{\text{total}}$ **Γ_{105}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.8	90	¹ PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

¹ Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.NODE=M053R14
NODE=M053R14

NODE=M053R14;LINKAGE=PE

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ **Γ_{106}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.5	90	¹ PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

¹ Assuming maximal destructive interference between $\psi(3770)$ and continuum sources.NODE=M053R13
NODE=M053R13

NODE=M053R13;LINKAGE=PE

 $\Gamma(\gamma \pi^0)/\Gamma_{\text{total}}$ **Γ_{107}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<2	90	PEDLAR	09	CLE3 $\psi(2S) \rightarrow \gamma X$

NODE=M053R12
NODE=M053R12 **$\psi(3770)$ REFERENCES**

NODE=M053

ABLIKIM	23BC	PR D108 052015	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23V	PR D107 L091101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21Z	PRL 127 082002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)
AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHAMOV	17	PL B769 187	A.G. Shamov, K.Yu. Todyshev	
ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15J	PR D91 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)
ABLIKIM	14H	PR D89 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	14L	PL B735 101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	14O	PR D90 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BONVICINI	14	PR D89 072002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

REFID=62423
REFID=62437
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REFID=59697
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ABLIKIM	13Q	PR D87 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55393
ANASHIN	12A	PL B711 292	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=54055
ABLIKIM	10D	EPJ C66 11	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53350
BESSION	10	PRL 104 159901 (err.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
ABLIKIM	09C	EPJ C64 243	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=53134
PEDLAR	09	PR D79 111101	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=52998
ABLIKIM	08B	PL B659 74	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52129
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
ABLIKIM	08H	PRL 101 102004	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52254
ABLIKIM	08M	PL B670 179	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52569
ABLIKIM	08N	PL B670 184	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52570
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
ABLIKIM	07B	PL B650 111	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51704
ABLIKIM	07E	PL B652 238	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51882
ABLIKIM	07F	PL B656 30	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51940
ABLIKIM	07I	EPJ C52 805	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52045
ABLIKIM	07K	PR D76 122002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52073
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
DOBBS	07	PR D76 112001	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=52075
ABLIKIM	06L	PRL 97 121801	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51129
ABLIKIM	06N	PL B641 145	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51131
ADAM	06	PRL 96 082004	N.E. Adam <i>et al.</i>	(CLEO Collab.)	REFID=50989
ADAMS	06	PR D73 012002	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50990
BESSION	06	PRL 96 092002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51041
Also		PRL 104 159901 (err.)	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=53245
BRIERE	06	PR D74 031106	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51149
COAN	06A	PRL 96 182002	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51155
CRONIN-HEN...	06	PR D74 012005	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=51156
HUANG	06A	PRL 96 032003	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=50999
BAI	05	PL B605 63	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50332
HE	05	PRL 95 121801	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=50924
Also		PRL 96 199903 (err.)	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51211
ABLIKIM	04F	PR D70 077101	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50185
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50331
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
ADLER	88C	PRL 60 89	J. Adler <i>et al.</i>	(Mark III Collab.)	REFID=40361
SCHINDLER	80	PR D21 2716	R.H. Schindler <i>et al.</i>	(Mark II Collab.)	REFID=22222
BACINO	78	PRL 40 671	W.J. Bacino <i>et al.</i>	(SLAC, UCLA, UCI)	REFID=11437
RAPIDIS	77	PRL 39 526	P.A. Rapidis <i>et al.</i>	(LGW Collab.)	REFID=22220

$\psi_2(3823)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

I, J, P need confirmation.

was $\psi(3823)$, $X(3823)$

Seen by BHARDWAJ 13 in $B \rightarrow \chi_{c1} \gamma K$ and ABLIKIM 15S in $e^+ e^- \rightarrow \pi^+ \pi^- \gamma \chi_{c1}$ decays as a narrow peak in the invariant mass distribution of the $\chi_{c1} \gamma$ system. Properties consistent with the $\psi_2(1^3D_2) c\bar{c}$ state.

$\psi_2(3823)$ MASS

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

3823.51 ± 0.34 OUR AVERAGE

[3823.5 ± 0.5 MeV OUR 2023 AVERAGE Scale factor = 1.4]

3824.5 ± 2.4 ± 1.0	30	¹ ABLIKIM	23J BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$
3823.12 ± 0.43 ± 0.13	120	ABLIKIM	22R BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
3824.08 ± 0.53 ± 0.14	137	² AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
3823.1 ± 1.8 ± 0.7	33 ± 10	³ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3821.7 ± 1.3 ± 0.7	19 ± 5	⁴ ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

¹ Using the measured $m_{\psi_2(3823)} - m_{\psi(2S)}$ and assuming $m_{\psi(2S)} = 3686.097$ MeV from PDG 22.

² Using the measured $m_{\psi_2(3823)} - m_{\psi(2S)} = 137.98 \pm 0.53 \pm 0.14$ MeV.

³ From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics. Corrected for the measured $\psi(2S)$ mass using $B \rightarrow \psi(2S) K \rightarrow (\gamma \chi_{c1}) K$ decays.

⁴ From a simultaneous unbinned maximum likelihood fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1} \gamma$ and $\psi_2(3823) \rightarrow \chi_{c1} \gamma$ together, with floating mass scale offset for $\psi(2S)$, floating $\psi_2(3823)$ mass, and zero $\psi_2(3823)$ width, resulting in a significance of 5.9σ when including systematic uncertainties. Superseded by ABLIKIM 22R.

NODE=M212

NODE=M212

NODE=M212M

NODE=M212M

NEW

NODE=M212M;LINKAGE=D

NODE=M212M;LINKAGE=C

NODE=M212M;LINKAGE=A

NODE=M212M;LINKAGE=B

$m_{\psi_2(3823)} - m_{\psi(2S)}$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$137.98 \pm 0.53 \pm 0.14$	137	¹ AAIJ	20s LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

¹ AAIJ 20s also reports $m_{\chi_{c1}(3872)} - m_{\psi_2(3823)} = 47.50 \pm 0.53 \pm 0.13$ MeV.

NODE=M212A00
NODE=M212A00

NODE=M212A00;LINKAGE=A

 $\psi_2(3823)$ WIDTH

VALUE (MeV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

< 2.9 90 120 ABLIKIM 22R BES3 $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18.8	90	30	¹ ABLIKIM	23J BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$

< 5.2	90		² AAIJ	20s LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

<16	90		³ ABLIKIM	15s BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

<24	90		⁴ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

¹ From a fit of $e^+ e^- \rightarrow \pi^0 \pi^0 \chi_{c1} \gamma$ data at $\sqrt{s}$ values from 4.23 to 4.70 GeV to a Breit-Wigner function with floating width, using the Bayesian approach.

² AAIJ 20s also provides a limit of < 6.6 MeV with 95% CL.

³ From a fit of $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$ data (the $\pi^+ \pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to a Breit-Wigner function with the mass fixed from the likelihood fit above, Gaussian resolution smearing, and floating width.

⁴ From a simultaneous fit to $B^\pm \rightarrow (\chi_{c1} \gamma) K^\pm$ and $B^0 \rightarrow (\chi_{c1} \gamma) K_S^0$ with significance 4.0σ including systematics.

NODE=M212W

NODE=M212W

NODE=M212W;LINKAGE=D

NODE=M212W;LINKAGE=C

NODE=M212W;LINKAGE=B

NODE=M212W;LINKAGE=A

 $\psi_2(3823)$ DECAY MODES

Branching fractions are given relative to the one **DEFINED AS 1**.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S) \pi^+ \pi^-$	<0.06	90%
Γ_2 $J/\psi(1S) \pi^0 \pi^0$	<0.11	90%
Γ_3 $J/\psi(1S) \pi^0$	<0.030	90%
Γ_4 $J/\psi(1S) \eta$	<0.14	90%
Γ_5 $\chi_{c0} \gamma$	<0.24	90%
Γ_6 $\chi_{c1} \gamma$	DEFINED AS 1	
Γ_7 $\chi_{c2} \gamma$	$0.28^{+0.14}_{-0.11}$	

NODE=M212215;NODE=M212

NODE=M212

DESIG=3

DESIG=5

DESIG=6

DESIG=7

DESIG=4

DESIG=1

DESIG=2

 $\psi_2(3823)$ BRANCHING RATIOS

$\Gamma(J/\psi(1S) \pi^+ \pi^-)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen		¹ ABLIKIM	210 BES3	$e^+ e^- \rightarrow \pi^+ \pi^- X$

seen	137 ± 26	AAIJ	20s LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+ \pi^-$ recoil mass distributions of seven decay channels in the process $e^+ e^- \rightarrow \pi^+ \pi^- X$.

NODE=M212R00
NODE=M212R00

NODE=M212R00;LINKAGE=A

$\Gamma(J/\psi(1S) \pi^+ \pi^-)/\Gamma(\chi_{c1} \gamma)$ **Γ_1/Γ_6**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.06 90 ¹ ABLIKIM 210 BES3 $e^+ e^- \rightarrow \pi^+ \pi^- X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+ \pi^-$ recoil mass distributions of seven decay channels in the process $e^+ e^- \rightarrow \pi^+ \pi^- X$.

NODE=M212R06
NODE=M212R06

NODE=M212R06;LINKAGE=A

$\Gamma(J/\psi(1S) \pi^0 \pi^0)/\Gamma(\chi_{c1} \gamma)$ **Γ_2/Γ_6**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.11 90 ¹ ABLIKIM 210 BES3 $e^+ e^- \rightarrow \pi^+ \pi^- X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+ \pi^-$ recoil mass distributions of seven decay channels in the process $e^+ e^- \rightarrow \pi^+ \pi^- X$.

NODE=M212R07
NODE=M212R07

NODE=M212R07;LINKAGE=A

$\Gamma(J/\psi(1S) \pi^0)/\Gamma(\chi_{c1} \gamma)$ **Γ_3/Γ_6**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.03 90 ¹ ABLIKIM 210 BES3 $e^+ e^- \rightarrow \pi^+ \pi^- X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+ \pi^-$ recoil mass distributions of seven decay channels in the process $e^+ e^- \rightarrow \pi^+ \pi^- X$.

NODE=M212R08
NODE=M212R08

NODE=M212R08;LINKAGE=A

$\Gamma(J/\psi(1S)\eta)/\Gamma(\chi_{c1}\gamma)$ Γ_4/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	90	¹ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R09
NODE=M212R09

NODE=M212R09;LINKAGE=A

 $\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$ Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
$4.4^{+2.5}_{-1.9} \pm 0.9$	¹ AAIJ	22D LHCb	$B^+ \rightarrow J/\psi(1S)\eta K^+$

¹ Using the branching ratio for $B^+ \rightarrow \psi_2(3823)K^+$ with $\psi_2(3823) \rightarrow J/\psi(1S)\pi^+\pi^-$ from AAIJ 20S.

NODE=M212R10
NODE=M212R10

NODE=M212R10;LINKAGE=A

 $\Gamma(\chi_{c0}\gamma)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	¹ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R04
NODE=M212R04

NODE=M212R04;LINKAGE=A

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	120	¹ ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
seen	63 ± 9	² ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-X$
seen	16 ± 5	³ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^0\pi^0X$
seen	33 ± 10	⁴ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1}\gamma K^\pm$

¹ From a fit to the $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak R with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV, which leads to $\Gamma(e^+e^-)B(R \rightarrow \pi^+\pi^-\psi_2(3823))B(\psi_2(3823) \rightarrow \chi_{c1}\gamma) = 0.57 \pm 0.08$ eV.

² From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$. Signal has a 11.8 σ significance.

³ From a fit of the invariant $\pi^0\pi^0$ recoil-mass distribution. Signal has a 4.3 σ significance.

⁴ BHARDWAJ 13 reports $B(B^\pm \rightarrow \psi_2(3823)K^\pm) \times B(\psi_2(3823) \rightarrow \gamma\chi_{c1}) = (9.7 \pm 2.8 \pm 1.1) \times 10^{-6}$ with statistical significance 3.8 σ .

NODE=M212R01
NODE=M212R01

OCCUR=2

NODE=M212R01;LINKAGE=D

NODE=M212R01;LINKAGE=B

NODE=M212R01;LINKAGE=C
NODE=M212R01;LINKAGE=A

 $\Gamma(\chi_{c0}\gamma)/\Gamma(\chi_{c1}\gamma)$ Γ_5/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.24	90	¹ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-X$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

NODE=M212R05
NODE=M212R05

NODE=M212R05;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	¹ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-X$
not seen	² ABLIKIM	15S BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
not seen	³ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c2}\gamma K^\pm$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$. Signal has a 3.2 σ significance.

² From a simultaneous unbinned maximum likelihood fit of $e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$ data (the $\pi^+\pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c2}\gamma$ and $\psi_2(3823) \rightarrow \chi_{c2}\gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi_2(3823)$ mass floating (fixed to that above), and zero $\psi_2(3823)$ width.

³ BHARDWAJ 13 reports $B(B^\pm \rightarrow \psi_2(3823)K^\pm) \times B(\psi_2(3823) \rightarrow \gamma\chi_{c2}) < 3.6 \times 10^{-6}$ at 90% CL.

NODE=M212R02
NODE=M212R02

NODE=M212R02;LINKAGE=C

NODE=M212R02;LINKAGE=B

NODE=M212R02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma)/\Gamma(\chi_{c1}\gamma)$ Γ_7/Γ_6

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.28^{+0.14}_{-0.11} \pm 0.02$		9 ± 4	¹ ABLIKIM	210 BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.42	90		² ABLIKIM	15s BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
<0.41	90		BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1}/c2\gamma K^\pm$

¹ From a simultaneous unbinned maximum likelihood fit of the $\pi^+\pi^-$ recoil mass distributions of seven decay channels in the process $e^+e^- \rightarrow \pi^+\pi^-X$.

² From a simultaneous unbinned maximum likelihood fit of $e^+e^- \rightarrow \pi^+\pi^-\chi_{c1(2)}\gamma$ data (the $\pi^+\pi^-$ recoil mass) taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to simulated events including both $\psi(2S) \rightarrow \chi_{c1(2)}\gamma$ and $\psi_2(3823) \rightarrow \chi_{c1(2)}\gamma$ together, with floating mass scale offset for $\psi(2S)$, $\psi_2(3823)$ mass floating (fixed to that above), and zero $\psi_2(3823)$ width.

NODE=M212R03
NODE=M212R03

NODE=M212R03;LINKAGE=B

NODE=M212R03;LINKAGE=A

$\psi_2(3823)$ REFERENCES

ABLIKIM	23J	JHEP 2302 171	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	22D	JHEP 2204 046	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)
ABLIKIM	21O	PR D103 L091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	20S	JHEP 2008 123	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BHARDWAJ	13	PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)

NODE=M212

REFID=62052
REFID=61647
REFID=61664
REFID=61634
REFID=61121
REFID=60526
REFID=56784
REFID=55412

NODE=M241

$\psi_3(3842)$

$I^G(J^{PC}) = 0^-(3^{--})$
 J, P need confirmation.

J^P has not been measured, 3^- is the quark model prediction.

NODE=M241

$\psi_3(3842)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3842.71 \pm 0.16 \pm 0.12$	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241M

NODE=M241M

$\psi_3(3842)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$2.79 \pm 0.51 \pm 0.35$	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241W

NODE=M241W

$\psi_3(3842)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 D^+D^-	seen
Γ_2 $D^0\bar{D}^0$	seen

NODE=M241215;NODE=M241

DESIG=1

DESIG=2

$\psi_3(3842)$ BRANCHING RATIOS

$\Gamma(D^+D^-)/\Gamma_{\text{total}}$

Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	¹ ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^-D^+D^-$

¹ From a fit to the $\pi^+\pi^-$ recoil mass for $e^+e^- \rightarrow D^+D^-\pi^+\pi^-$.

NODE=M241225

NODE=M241R01
NODE=M241R01

NODE=M241R01;LINKAGE=A

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$

Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241R02
NODE=M241R02

$\psi_3(3842)$ REFERENCES

ABLIKIM	22AL	PR D106 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M241

REFID=61884
REFID=59697

NODE=M237

$\chi_{c0}(3860)$

$I^G(J^{PC}) = 0^+(0^{++})$

OMITTED FROM SUMMARY TABLE

The assignment $J^P = 0^+$ is preferred over 2^+ by 2.5 sigma.

NODE=M237

Observed by CHILIKIN 17 using full amplitude analysis of the process $e^+e^- \rightarrow J/\psi D\bar{D}$, where $D = D^0, D^+$. Not seen by AAIJ 20AI in the decay $B^+ \rightarrow D^+ D^- K^+$.

$\chi_{c0}(3860)$ MASS

NODE=M237M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
3862^{+26+40}_{-32-13}	CHILIKIN	17	BELL $e^+e^- \rightarrow J/\psi D\bar{D}$

NODE=M237M

$\chi_{c0}(3860)$ WIDTH

NODE=M237W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
200^{+180}_{-110} OUR AVERAGE	[201^{+180}_{-110} MeV OUR 2023 AVERAGE]		
$201^{+154+88}_{-67-82}$	CHILIKIN	17	BELL $e^+e^- \rightarrow J/\psi D\bar{D}$

NODE=M237W

NEW

$\chi_{c0}(3860)$ DECAY MODES

NODE=M237215;NODE=M237

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0\bar{D}^0$	seen
$\Gamma_2 \quad D^+D^-$	seen

DESIG=1

DESIG=2

$\chi_{c0}(3860)$ BRANCHING RATIOS

NODE=M237220

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	CHILIKIN	17	BELL	$e^+e^- \rightarrow J/\psi D^0\bar{D}^0$
$\Gamma(D^+D^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	CHILIKIN	17	BELL	$e^+e^- \rightarrow J/\psi D^+D^-$

NODE=M237R00
NODE=M237R00

NODE=M237R01
NODE=M237R01

$\chi_{c0}(3860)$ REFERENCES

NODE=M237

AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHILIKIN	17	PR D95 112003	K. Chilikin <i>et al.</i>	(BELLE Collab.) JPC

REFID=60739
REFID=57995

$\chi_{c1}(3872)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

NODE=M176

also known as $X(3872)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M176

First observed by CHOI 03 in $B \rightarrow K\pi^+\pi^- J/\psi(1S)$ decays as a narrow peak in the invariant mass distribution of the $\pi^+\pi^- J/\psi(1S)$ final state. Isovector hypothesis excluded by AUBERT 05B and CHOI 11.

AAIJ 13Q perform a full five-dimensional amplitude analysis of the angular correlations between the decay products in $B^+ \rightarrow \chi_{c1}(3872)K^+$ decays, where $\chi_{c1}(3872) \rightarrow J/\psi\pi^+\pi^-$ and $J/\psi \rightarrow \mu^+\mu^-$, which unambiguously gives the $J^{PC} = 1^{++}$ assignment under the assumption that the $\pi^+\pi^-$ and J/ψ are in an S -wave. AAIJ 15AO extend this analysis with more data to limit D -wave contributions to $< 4\%$ at 95% CL.

See the review on "Spectroscopy of Mesons Containing Two Heavy Quarks."

 $\chi_{c1}(3872)$ MASS FROM $J/\psi X$ MODE

NODE=M176M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.64 $\pm$ 0.06 OUR AVERAGE				
[3871.65 $\pm$ 0.06 MeV OUR 2023 AVERAGE]				
3870.2 $\pm$ 0.7 $\pm$ 0.3	24.6	ABLIKIM	23W BES3	$e^+e^- \rightarrow J/\psi(1S)\pi^+\pi^-\omega$
3871.64 $\pm$ 0.06 $\pm$ 0.01	19.8k	¹ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi\pi^+\pi^-K^+$
3871.9 $\pm$ 0.7 $\pm$ 0.2	20	ABLIKIM	14 BES3	$e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$
3871.95 $\pm$ 0.48 $\pm$ 0.12	0.6k	AAIJ	12H LHCb	$pp \rightarrow J/\psi\pi^+\pi^-X$
3871.85 $\pm$ 0.27 $\pm$ 0.19	170	² CHOI	11 BELL	$B \rightarrow K\pi^+\pi^- J/\psi$
3873 $\pm$ 1.8 $\pm$ 1.6	27	³ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3871.61 $\pm$ 0.16 $\pm$ 0.19	6k	^{3,4} AALTONEN	09AU CDF2	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
3871.4 $\pm$ 0.6 $\pm$ 0.1	93.4	AUBERT	08Y BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$
3868.7 $\pm$ 1.5 $\pm$ 0.4	9.4	AUBERT	08Y BABR	$B^0 \rightarrow K_S^0 J/\psi\pi^+\pi^-$
3871.8 $\pm$ 3.1 $\pm$ 3.0	522	^{3,5} ABAZOV	04F D0	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3871.57 $\pm$ 0.09	155	⁶ AAIJ	23AP LHCb	$B_s^0 \rightarrow J/\psi 2(\pi^+\pi^-)$
3871.695 $\pm$ 0.067 $\pm$ 0.068	15.6k	⁷ AAIJ	20AD LHCb	$pp \rightarrow J/\psi\pi^+\pi^-X$
3871.59 $\pm$ 0.06 $\pm$ 0.03	4.2k	⁸ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi\pi^+\pi^-K^+$
3873.3 $\pm$ 1.1 $\pm$ 1.0	45	⁹ ABLIKIM	19V BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
3860.0 $\pm$ 10.4	13.6	^{3,10} AGHASYAN	18A COMP	$\gamma^* N \rightarrow X\pi^\pm N'$
3868.6 $\pm$ 1.2 $\pm$ 0.2	8	¹¹ AUBERT	06 BABR	$B^0 \rightarrow K_S^0 J/\psi\pi^+\pi^-$
3871.3 $\pm$ 0.6 $\pm$ 0.1	61	¹¹ AUBERT	06 BABR	$B^- \rightarrow K^- J/\psi\pi^+\pi^-$
3873.4 $\pm$ 1.4	25	¹² AUBERT	05R BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$
3871.3 $\pm$ 0.7 $\pm$ 0.4	730	^{3,13} ACOSTA	04 CDF2	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
3872.0 $\pm$ 0.6 $\pm$ 0.5	36	¹⁴ CHOI	03 BELL	$B \rightarrow K\pi^+\pi^- J/\psi$
3836 $\pm$ 13	58	^{3,15} ANTONIAZZI	94 E705	$300\pi^\pm Li \rightarrow J/\psi\pi^+\pi^-X$

NODE=M176M

NEW

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Calculated from $m_{\chi_{c1}(3872)} - m_{\psi(2S)} = 185.54 \pm 0.06$ MeV obtained by combining the data with $\chi_{c1}(3872)$ produced in B^+ decays from AAIJ 20S and inclusive b -hadron decays from AAIJ 20AD and using $m_{\psi(2S)} = 3686.097$ MeV. Breit-Wigner parametrization.
- ² The mass difference for the $\chi_{c1}(3872)$ produced in B^+ and B^0 decays is $(-0.71 \pm 0.96 \pm 0.19)$ MeV.
- ³ Width consistent with detector resolution.
- ⁴ A possible equal mixture of two states with a mass difference greater than 3.6 MeV/ c^2 is excluded at 95% CL.
- ⁵ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{J/\psi}$ using $m_{J/\psi} = 3096.916$ MeV.
- ⁶ From a fit of a relativistic S -wave Breit-Wigner convolved with the detector resolution. The width of $\chi_{c1}(3872)$ is constrained to the PDG 22 value. Systematic errors not evaluated.
- ⁷ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays and $m_{\psi(2S)} = 3686.097 \pm 0.010$ MeV. Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.
- ⁸ Using Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.
- ⁹ Fit with fixed width and including two resonances, $\chi_{c0}(3915)$ and $X(3960)$.
- ¹⁰ Could be a different state.
- ¹¹ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. Superseded by AUBERT 08Y.
- ¹² Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$ MeV. Superseded by AUBERT 06.
- ¹³ Superseded by AALTONEN 09AU.
- ¹⁴ Superseded by CHOI 11.
- ¹⁵ A lower mass value can be due to an incorrect momentum scale for soft pions.

$\chi_{c1}(3872)$ MASS FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$3873.71^{+0.56}_{-0.50} \pm 0.13$		¹ HIRATA	23	BELL $B^0 \rightarrow D^0 \bar{D}^{*0} K^0$, $B^+ \rightarrow D^0 \bar{D}^{*0} K^+$
$3872.9^{+0.6}_{-0.4} \pm 0.4$	50	^{2,3} AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$
$3875.1^{+0.7}_{-0.5} \pm 0.5$	33 ± 6	³ AUBERT	08B	BABR $B \rightarrow \bar{D}^{*0} D^0 K$
3875.2 ± 0.7	24 ± 6	^{3,4} GOKHROO	06	BELL $B \rightarrow D^0 \bar{D}^0 \pi^0 K$

- ¹ From a fit of a Breit-Wigner function with energy dependent width.
- ² Calculated from the measured $m_{\chi_{c1}(3872)} - m_{D^{*0}} - m_{\bar{D}^0} = 1.1^{+0.6+0.1}_{-0.4-0.3}$ MeV.
- ³ Experiments report $D^{*0} \bar{D}^0$ invariant mass above $D^{*0} \bar{D}^0$ threshold because D^{*0} decay products are kinematically constrained to the D^{*0} mass, even though the D^{*0} may decay off-shell.
- ⁴ Superseded by AUSHEV 10.

$m_{\chi_{c1}(3872)} - m_{J/\psi}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$774.9 \pm 3.1 \pm 3.0$	522	ABAZOV	04F	D0 $p\bar{p} \rightarrow J/\psi \pi^+ \pi^- X$

$m_{\chi_{c1}(3872)} - m_{\psi(2S)}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$185.598 \pm 0.067 \pm 0.068$	15.6k	¹ AAIJ	20AD	LHCB $pp \rightarrow J/\psi \pi^+ \pi^- X$
185.54 ± 0.06	19.8k	² AAIJ	20S	LHCB $pp \rightarrow J/\psi \pi^+ \pi^- X$
187.4 ± 1.4	25	³ AUBERT	05R	BABR $B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$

- ¹ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays. Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.
- ² Combining $m_{\chi_{c1}(3872)} - m_{\psi(2S)} = 185.49 \pm 0.06 \pm 0.03$ MeV from AAIJ 20S and the measured mass difference from AAIJ 20AD. Breit-Wigner parametrization.
- ³ Superseded by AUBERT 06.

$\chi_{c1}(3872)$ WIDTH

VALUE (MeV)	CL% EVTS	DOCUMENT ID	TECN	COMMENT
1.19 ± 0.21 OUR AVERAGE		Error includes scale factor of 1.1.		
$1.39 \pm 0.24 \pm 0.10$	15.6k	¹ AAIJ	20AD	LHCB $pp \rightarrow J/\psi \pi^+ \pi^- X$
$0.96^{+0.19}_{-0.18} \pm 0.21$	4.2k	² AAIJ	20S	LHCB $B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

NODE=M176M;LINKAGE=F

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC
NODE=M176M;LINKAGE=AANODE=M176M;LINKAGE=AB
NODE=M176M;LINKAGE=H

NODE=M176M;LINKAGE=D

NODE=M176M;LINKAGE=E

NODE=M176M;LINKAGE=B
NODE=M176M;LINKAGE=A

NODE=M176M;LINKAGE=AE

NODE=M176M;LINKAGE=AU

NODE=M176M;LINKAGE=AT
NODE=M176M;LINKAGE=CH
NODE=M176M;LINKAGE=AN

NODE=M176MD0

NODE=M176MD0

NODE=M176MD0;LINKAGE=A

NODE=M176MD0;LINKAGE=AS
NODE=M176MD0;LINKAGE=AU

NODE=M176MD0;LINKAGE=GO

NODE=M176DM

NODE=M176DM

NODE=M176DM2

NODE=M176DM2

NODE=M176DM2;LINKAGE=A

NODE=M176DM2;LINKAGE=E

NODE=M176DM2;LINKAGE=AU

NODE=M176W

NODE=M176W

OCCUR=3

OCCUR=2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.4	90	ABLIKIM	14	BES3	$e^+e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$
<1.2	90	CHOI	11	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$
<3.3	90	AUBERT	08Y	BABR	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
<4.1	90	69 AUBERT	06	BABR	$B \rightarrow K \pi^+ \pi^- J/\psi$
<2.3	90	36 ³ CHOI	03	BELL	$B \rightarrow K \pi^+ \pi^- J/\psi$

¹ Using $\chi_{c1}(3872)$ produced in inclusive b -hadron decays. Breit-Wigner parametrization.

² Using Breit-Wigner parametrization. Partially overlapping dataset with that of AAIJ 20AD.

³ Superseded by CHOI 11.

NODE=M176W;LINKAGE=E

NODE=M176W;LINKAGE=F

NODE=M176W;LINKAGE=CH

$\chi_{c1}(3872)$ WIDTH FROM $\bar{D}^{*0} D^0$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$5.2^{+2.2}_{-1.5} \pm 0.4$		¹ HIRATA	23	BELL	$B^0 \rightarrow D^0 \bar{D}^{*0} K^0$, $B^+ \rightarrow D^0 \bar{D}^{*0} K^+$
$3.9^{+2.8+0.2}_{-1.4-1.1}$	50	² AUSHEV	10	BELL	$B \rightarrow \bar{D}^{*0} D^0 K$
$3.0^{+1.9}_{-1.4} \pm 0.9$	33 $\pm$ 6	AUBERT	08B	BABR	$B \rightarrow \bar{D}^{*0} D^0 K$

¹ From a fit of a Breit-Wigner function with energy dependent width.

² With a measured value of $B(B \rightarrow \chi_{c1}(3872) K) \times B(\chi_{c1}(3872) \rightarrow D^{*0} \bar{D}^0) = (0.80 \pm 0.20 \pm 0.10) \times 10^{-4}$, assumed to be equal for both charged and neutral modes.

NODE=M176WD0

NODE=M176WD0

NODE=M176WD0;LINKAGE=B

NODE=M176WD0;LINKAGE=AU

$\chi_{c1}(3872)$ DECAY MODES

NODE=M176215;NODE=M176

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$< 2.7 \times 10^{-7}$	90%
Γ_2 $\pi^+ \pi^- \pi^0$	$< 8 \times 10^{-3}$	90%
Γ_3 $\pi^+ \pi^- J/\psi(1S)$	$(3.5 \pm 0.9) \%$	
Γ_4 $\pi^+ \pi^- \pi^0 J/\psi(1S)$	not seen	
Γ_5 $\omega \eta_c(1S)$	$< 30 \%$	90%
Γ_6 $\rho(770)^0 J/\psi(1S)$	$(2.8 \pm 0.7) \%$	
Γ_7 $\omega J/\psi(1S)$	$(4.1 \pm 1.4) \%$	
Γ_8 $\phi \phi$	not seen	
Γ_9 $D^0 \bar{D}^0 \pi^0$	$(45 \pm 21) \%$	
Γ_{10} $\bar{D}^{*0} D^0$	$(34 \pm 12) \%$	
Γ_{11} $\gamma \gamma$	$< 10 \%$	90%
Γ_{12} $D^0 \bar{D}^0$	$< 26 \%$	90%
Γ_{13} $D^+ D^-$	$< 17 \%$	90%
Γ_{14} $\pi^0 \chi_{c2}$	$< 4 \%$	90%
Γ_{15} $\pi^0 \chi_{c1}$	$(3.1^{+1.5}_{-1.3}) \%$	
Γ_{16} $\pi^0 \chi_{c0}$	$< 13 \%$	90%
Γ_{17} $\pi^+ \pi^- \eta_c(1S)$	$< 13 \%$	90%
Γ_{18} $\pi^0 \pi^0 \chi_{c0}$	$< 6 \%$	90%
Γ_{19} $\pi^+ \pi^- \chi_{c0}$	$< 2.0 \%$	90%
Γ_{20} $\pi^+ \pi^- \chi_{c1}$	$< 7 \times 10^{-3}$	90%
Γ_{21} $p \bar{p}$	$< 2.2 \times 10^{-5}$	95%

DESIG=1

DESIG=29

DESIG=2

DESIG=25

DESIG=24

DESIG=32

DESIG=13

DESIG=26

DESIG=8

DESIG=12

DESIG=5

DESIG=6

DESIG=7

DESIG=20

DESIG=18

DESIG=19

DESIG=14

DESIG=28

DESIG=27

DESIG=17

DESIG=16

Radiative decays

NODE=M176;CLUMP=B

Γ_{22} $\gamma D^+ D^-$	$< 3.5 \%$	90%
Γ_{23} $\gamma \bar{D}^0 D^0$	$< 6 \%$	90%
Γ_{24} $\gamma J/\psi$	$(7.8 \pm 2.9) \times 10^{-3}$	
Γ_{25} $\gamma \chi_{c1}$	$< 8 \times 10^{-3}$	90%
Γ_{26} $\gamma \chi_{c2}$	$< 2.9 \%$	90%
Γ_{27} $\gamma \psi(2S)$	possibly seen	

DESIG=21

DESIG=23

DESIG=9

DESIG=3

DESIG=15

DESIG=11

C-violating decays

NODE=M176;CLUMP=A

Γ_{28} $\eta J/\psi$	$< 1.7 \%$	90%

DESIG=4

$\chi_{c1}(3872)$ PARTIAL WIDTHS $\Gamma(e^+e^-)$ Γ_1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.32	90	¹ ABLIKIM	230 BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 4.3	90	² ABLIKIM	15v BES3	$4.0\text{--}4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
<280	90	³ YUAN	04 RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Fit to cross section using a total width value of 1.19 ± 0.21 MeV and $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = (3.8 \pm 1.2)\%$ from PDG 20.

² ABLIKIM 15v reports this limit from the measurement of $\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) \times \Gamma(\chi_{c1}(3872) \rightarrow e^+e^-)/\Gamma < 0.13$ eV using $\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma = 3\%$.

³ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$. Assuming that $\Gamma(\pi^+\pi^- J/\psi)$ of $\chi_{c1}(3872)$ is the same as that of $\psi(2S)$ (85.4 keV).

NODE=M176220

NODE=M176W1
NODE=M176W1

NODE=M176W1;LINKAGE=C

NODE=M176W1;LINKAGE=B

NODE=M176W1;LINKAGE=A

 $\chi_{c1}(3872) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M176230

 $\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 7.5×10^{-3} (CL = 90%)		[<0.13 eV (CL = 90%) OUR 2023 BEST LIMIT]		
< 7.5×10^{-3}	90	¹ ABLIKIM	230 BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 0.13	90	ABLIKIM	15v BES3	$4.0\text{--}4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
< 6.2	90	^{2,3} AUBERT	05D BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$
< 8.3	90	³ DOBBS	05 CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
<10	90	⁴ YUAN	04 RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Fit to cross section using a total width value of 1.19 ± 0.21 MeV from PDG 20.

² Using $B(\chi_{c1}(3872) \rightarrow J/\psi\pi^+\pi^-) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot \Gamma(\chi_{c1}(3872) \rightarrow e^+e^-) < 0.37$ eV from AUBERT 05D and $B(J/\psi \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$ from the PDG 04.

³ Assuming $\chi_{c1}(3872)$ has $J^{PC} = 1^{--}$.

⁴ Using BAI 98E data on $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+\mu^-) = (5.88 \pm 0.10)\%$.

NODE=M176G1;LINKAGE=B
NODE=M176G1;LINKAGE=AUNODE=M176G1;LINKAGE=DO
NODE=M176G1;LINKAGE=A $\chi_{c1}(3872) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M176232

 $\Gamma(\pi^+\pi^- J/\psi(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_3\Gamma_{11}/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$5.5^{+4.1}_{-3.8} \pm 0.7$		3	¹ TERAMOTO	21 BELL	$e^+e^- \rightarrow \gamma^*\gamma$ at $\Upsilon(nS)$
<12.9	90		² DOBBS	05 CLE3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi\gamma$

¹ Measured in single-tag two-photon production assuming Q^2 dependence of a $c\bar{c}$ meson model. Here, $\Gamma(\chi_{c1}(3872) \rightarrow \gamma\gamma)$ is the reduced two-photon decay width, $\tilde{\Gamma}_{\gamma\gamma}$.

² Assuming $\chi_{c1}(3872)$ has positive C parity and spin 0.

NODE=M176H1;LINKAGE=A

NODE=M176H1;LINKAGE=DO

 $\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_{11}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.7	90	¹ LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$

¹ Assuming $\chi_{c1}(3872)$ has spin 2.

NODE=M176G01
NODE=M176G01

NODE=M176G01;LINKAGE=LE

 $\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_{11}/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<11.1	90	LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$

NODE=M176G02
NODE=M176G02

$\chi_{c1}(3872)$ BRANCHING RATIOS $\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.8 (CL = 90%) [$<0.9\%$ (CL = 90%) OUR 2023 BEST LIMIT]				
<0.8	90	1,2 YIN	23 BELL	$B^+ \rightarrow \chi_{c1}(3872)K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.1	90	2,3 YIN	23 BELL	$B^0 \rightarrow \chi_{c1}(3872)K^0$
¹ YIN 23 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 1.9 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$. ² Assuming the decay products, $\pi^+\pi^-\pi^0$, are uniformly distributed in phase space. The limit is the 90% "credible" upper limit (i.e. Bayesian). ³ YIN 23 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(B^0 \rightarrow \chi_{c1}(3872)K^0)] < 1.5 \times 10^{-6}$ which we divide by our best value $B(B^0 \rightarrow \chi_{c1}(3872)K^0) = 1.4 \times 10^{-4}$.				

NODE=M176235

NODE=M176R30
NODE=M176R30

OCCUR=2

NODE=M176R30;LINKAGE=A

NODE=M176R30;LINKAGE=E

NODE=M176R30;LINKAGE=D

 $\Gamma(\pi^+\pi^-J/\psi(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.035±0.009 OUR AVERAGE [0.038 ± 0.012 OUR 2023 AVERAGE]				
0.035±0.002±0.009		¹ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
0.038±0.004±0.010		² CHOI	11 BELL	$B^+ \rightarrow \pi^+ \pi^- J/\psi K^+$
0.037±0.007 ^{+0.009} _{-0.010}	93	3,4 AUBERT	08Y BABR	$B \rightarrow \chi_{c1}(3872)K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	151	⁵ BALA	15 BELL	$B \rightarrow \chi_{c1}(3872)K\pi$
0.056±0.018 ^{+0.014} _{-0.015}	30	⁶ AUBERT	05R BABR	$B^+ \rightarrow K^+ \pi^+ \pi^- J/\psi$
0.060±0.013±0.016	36	⁷ CHOI	03 BELL	$B^+ \rightarrow K^+ \pi^+ \pi^- J/\psi$
¹ AAIJ 20S reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (7.95 \pm 0.15 \pm 0.33) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. ² CHOI 11 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (8.63 \pm 0.82 \pm 0.52) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. ³ AUBERT 08Y reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (8.4 \pm 1.5 \pm 0.7) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. ⁴ superseded by LEES 20C ⁵ BALA 15 reports $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi) \times B(B^0 \rightarrow \chi_{c1}(3872)K^+\pi^-) = (7.9 \pm 1.3 \pm 0.4) \times 10^{-6}$ and $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi) \times B(B^+ \rightarrow \chi_{c1}(3872)K^0\pi^+) = (10.6 \pm 3.0 \pm 0.9) \times 10^{-6}$. ⁶ Superseded by AUBERT 08Y. AUBERT 05R reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (1.28 \pm 0.41) \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. ⁷ CHOI 03 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] / [B(B^+ \rightarrow \psi(2S)K^+)] / [B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)] = 0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.24 \pm 0.21) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.69 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.				

NODE=M176R6
NODE=M176R6
NEW

SYCLP=A

SYCLP=A

SYCLP=A

SYCLP=A

NODE=M176R6;LINKAGE=E

NODE=M176R6;LINKAGE=F

NODE=M176R6;LINKAGE=AB

NODE=M176R6;LINKAGE=C

NODE=M176R6;LINKAGE=A

NODE=M176R6;LINKAGE=AE

NODE=M176R6;LINKAGE=CH

 $\Gamma(\pi^+\pi^-\pi^0 J/\psi(1S))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ WANG	11B BELL	$\Upsilon(2S) \rightarrow \gamma X$
not seen	² SHEN	10A BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ WANG 11B reports $B(\Upsilon(2S) \rightarrow \gamma \chi_{c1}(3872)) \times B(\chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi) < 2.4 \times 10^{-6}$ at 95% CL. ² SHEN 10A reports $B(\Upsilon(1S) \rightarrow \gamma \chi_{c1}(3872)) \times B(\chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi) < 2.8 \times 10^{-6}$ at 95% CL.			

NODE=M176R25
NODE=M176R25

NODE=M176R25;LINKAGE=B

NODE=M176R25;LINKAGE=A

$\Gamma(\omega\eta_c(1S))/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.30 (CL = 90%)		[<0.33 (CL = 90%) OUR 2023 BEST LIMIT]		
<0.30	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow \omega\eta_c K^+$
¹ VINOKUROVA 15 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega\eta_c(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 6.9 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R24
 NODE=M176R24

NODE=M176R24;LINKAGE=A

 $\Gamma(\rho(770)^0 J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_6/Γ_3

VALUE (%)	DOCUMENT ID	TECN	COMMENT
78.6±2.3±2.0	¹ AAIJ	23s LHCb	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
¹ Assuming pure ρ contribution only, i.e. excluding the contribution from ρ - ω interference. Using $B(\rho^0 \rightarrow \pi^+ \pi^-) = 100\%$.			

NODE=M176R33
 NODE=M176R33

NODE=M176R33;LINKAGE=A

 $\Gamma(\omega J/\psi(1S))/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.026±0.010±0.007	21±7	¹ DEL-AMO-SA..10B	BABR	$B^+ \rightarrow \omega J/\psi K^+$
¹ DEL-AMO-SANCHEZ 10B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega J/\psi(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (6 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. DEL-AMO-SANCHEZ 10B also reports $B(B^0 \rightarrow \chi_{c1}(3872)K^0) \times B(\chi_{c1}(3872) \rightarrow J/\psi\omega) = (6 \pm 3 \pm 1) \times 10^{-6}$.				

NODE=M176R14
 NODE=M176R14

NODE=M176R14;LINKAGE=DE

 $\Gamma(\omega J/\psi(1S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_7/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
1.16±0.24 OUR AVERAGE	Error includes scale factor of 1.2. [1.1 ± 0.4 OUR 2023 AVERAGE Scale factor = 1.7]		
1.24±0.33±0.10	^{1,2} AAIJ	23s LHCb	$B^+ \rightarrow K^+ J/\psi \pi^+ \pi^-$
1.6 ^{+0.4} _{-0.3} ±0.2	³ ABLIKIM	19v BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
0.8 ±0.3	⁴ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
¹ AAIJ 23s reports $[\Gamma(\chi_{c1}(3872) \rightarrow \omega J/\psi(1S))/\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] \times [B(\omega(782) \rightarrow \pi^+\pi^-)] = (1.9 \pm 0.4 \pm 0.3) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-) = (1.53 \pm 0.12) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			
² Excluding ρ - ω interference effects.			
³ Fit with fixed width and including two resonances, $\chi_{c0}(3915)$ and $X(3960)$.			
⁴ Statistical and systematic errors added in quadrature. Uses the values of $B(B \rightarrow \chi_{c1}(3872)K) \times B(\chi_{c1}(3872) \rightarrow J/\psi \pi^+ \pi^-)$ reported in AUBERT 08Y, taking into account the common systematics.			

NODE=M176R15
 NODE=M176R15
 NEW

OCCUR=3

NODE=M176R15;LINKAGE=G

NODE=M176R15;LINKAGE=H
 NODE=M176R15;LINKAGE=A
 NODE=M176R15;LINKAGE=DE

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ AAIJ	17BB LHCb	pp at 7, 8 TeV
¹ AAIJ 17BB reports $B(b \rightarrow \chi_{c1}(3872)\text{anything}) \times B(\chi_{c1}(3872) \rightarrow \phi\phi) < 4.5 \times 10^{-7}$ at 95% CL.			

NODE=M176R26
 NODE=M176R26

NODE=M176R26;LINKAGE=A

 $\Gamma(D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.45^{+0.16+0.11}_{-0.19-0.12}		17	¹ GOKHROO 06	BELL	$B^+ \rightarrow D^0\bar{D}^0\pi^0 K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.26	90	² CHISTOV 04	BELL	Sup. by GOKHROO 06	
¹ GOKHROO 06 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (1.02 \pm 0.31+0.21-0.29) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0\bar{D}^0\pi^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 0.6 \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.					

NODE=M176R12
 NODE=M176R12

NODE=M176R12;LINKAGE=GO

NODE=M176R12;LINKAGE=A

 $\Gamma(D^0\bar{D}^0\pi^0)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_9/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<1.16	90	ABLIKIM	20W BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R17
 NODE=M176R17

$\Gamma(\bar{D}^{*0} D^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.34±0.08±0.09	41 ⁺⁹ ₋₈	¹ AUSHEV	10 BELL	$B^+ \rightarrow D^{*0} \bar{D}^0 K^+$

NODE=M176R13
 NODE=M176R13
 SYCLP=A

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.73±0.26±0.19 27 ± 6 ² AUBERT 08B BABR $B^+ \rightarrow \bar{D}^{*0} D^0 K^+$

SYCLP=A

¹ AUSHEV 10 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] = (0.77 \pm 0.16 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R13;LINKAGE=AS

² AUBERT 08B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \bar{D}^{*0} D^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] = (1.67 \pm 0.36 \pm 0.47) \times 10^{-4}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R13;LINKAGE=AU

 $\Gamma(\bar{D}^{*0} D^0)/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{10}/Γ_3

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
11.77±3.09	50	ABLIKIM	20W BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R16
 NODE=M176R16

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.10 (CL = 90%)	[<0.11 (CL = 90%) OUR 2023 BEST LIMIT]			

NODE=M176R09
 NODE=M176R09

<0.10 90 ¹ WICHT 08 BELL $e^+ e^- \rightarrow \gamma(4S)$

¹ WICHT 08 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 2.4 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.3 \times 10^{-4}$.

NODE=M176R09;LINKAGE=A

 $\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.26 (CL = 90%)	[<0.29 (CL = 90%) OUR 2023 BEST LIMIT]			

NODE=M176R3
 NODE=M176R3

<0.26 90 ¹ CHISTOV 04 BELL $B \rightarrow K D^0 \bar{D}^0$

¹ CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^0 \bar{D}^0)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 6 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.3 \times 10^{-4}$.

NODE=M176R3;LINKAGE=A

 $\Gamma(D^+ D^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.17 (CL = 90%)	[<0.19 (CL = 90%) OUR 2023 BEST LIMIT]			

NODE=M176R4
 NODE=M176R4

<0.17 90 ¹ CHISTOV 04 BELL $B \rightarrow K D^+ D^-$

¹ CHISTOV 04 reports $[\Gamma(\chi_{c1}(3872) \rightarrow D^+ D^-)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 4 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.3 \times 10^{-4}$.

NODE=M176R4;LINKAGE=A

 $\Gamma(\pi^0 \chi_{c2})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{14}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	ABLIKIM	19U BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R06
 NODE=M176R06

 $\Gamma(\pi^0 \chi_{c1})/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M176R23
 NODE=M176R23

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.035 90 ¹ BHARDWAJ 19 BELL $B^\pm \rightarrow \pi^0 \chi_{c1} K^\pm$

¹ BHARDWAJ 19 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^0 \chi_{c1})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] < 8.1 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.3 \times 10^{-4}$.

NODE=M176R23;LINKAGE=A

 $\Gamma(\pi^0 \chi_{c1})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{15}/Γ_3

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT
88⁺³³₋₂₇±10	10.8	ABLIKIM	19U BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R05
 NODE=M176R05

 $\Gamma(\pi^0 \chi_{c0})/\Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{16}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 3.6	90	ABLIKIM	22D BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R04
 NODE=M176R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 90 ABLIKIM 19U BES3 $e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

$\Gamma(\pi^+\pi^-\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.13 (CL = 90%)		[<0.14 (CL = 90%) OUR 2023 BEST LIMIT]		
<0.13	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow \pi^+\pi^-\eta_c K^+$
¹ VINOKUROVA 15 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\eta_c(1S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 3.0 \times 10^{-5}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R22
NODE=M176R22

NODE=M176R22;LINKAGE=A

 $\Gamma(\pi^0\pi^0\chi_{c0})/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{18}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	ABLIKIM	22D	BES3 $e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R28
NODE=M176R28

 $\Gamma(\pi^+\pi^-\chi_{c0})/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{19}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.56	90	ABLIKIM	22D	BES3 $e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R29
NODE=M176R29

 $\Gamma(\pi^+\pi^-\chi_{c1})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7 × 10⁻³	90	¹ BHARDWAJ 16	BELL	$B^+ \rightarrow \pi^+\pi^-\chi_{c1}K^+$
¹ BHARDWAJ 16 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+\pi^-\chi_{c1})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 1.5 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R00
NODE=M176R00

NODE=M176R00;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10⁻⁵ (CL = 95%)		[<2.4 × 10 ⁻⁵ (CL = 95%) OUR 2023 BEST LIMIT]		
<2.2 × 10⁻⁵	95	¹ AAIJ	17AD	LHCB $B^+ \rightarrow p\bar{p}K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<7 × 10⁻⁵	95	² AAIJ	13s	LHCB $B^+ \rightarrow p\bar{p}K^+$
¹ AAIJ 17AD reports $[\Gamma(\chi_{c1}(3872) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 0.5 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				
² AAIJ 13s reports $[\Gamma(\chi_{c1}(3872) \rightarrow p\bar{p})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 1.7 \times 10^{-8}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R03
NODE=M176R03

SYCLP=A

SYCLP=A

NODE=M176R03;LINKAGE=C

NODE=M176R03;LINKAGE=B

Radiative decays

 $\Gamma(\gamma D^+ D^-)/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{22}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99	90	ABLIKIM	20W	BES3 $e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176410

NODE=M176R20
NODE=M176R20

 $\Gamma(\gamma \bar{D}^0 D^0)/\Gamma(\pi^+\pi^-J/\psi(1S))$ Γ_{23}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.58	90	ABLIKIM	20W	BES3 $e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R21
NODE=M176R21

 $\Gamma(\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
7.8 ± 2.9 OUR AVERAGE	[0.008 ± 0.004 OUR 2023 AVERAGE]			
7.8^{+2.2}_{-2.0} ± 2.0		¹ BHARDWAJ 11	BELL	$B^\pm \rightarrow \gamma J/\psi K^\pm$

NODE=M176R7
NODE=M176R7

NEW
SYCLP=A

• • • We do not use the following data for averages, fits, limits, etc. • • •

12.2 ± 3.5 ± 3.2	20	² AUBERT	09B	BABR $B^+ \rightarrow \gamma J/\psi K^+$
14 ± 5 ± 4	19	³ AUBERT, BE	06M	BABR $B^+ \rightarrow \gamma J/\psi K^+$

SYCLP=A

SYCLP=A

¹ BHARDWAJ 11 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (1.78^{+0.48}_{-0.44} \pm 0.12) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² AUBERT 09B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (2.8 \pm 0.8 \pm 0.1) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R7;LINKAGE=BA

NODE=M176R7;LINKAGE=AB

³ Superseded by AUBERT 09B. AUBERT, BE 06M reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (3.3 \pm 1.0 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R7;LINKAGE=AU

$\Gamma(\gamma J/\psi)/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{24}/Γ_3

VALUE	DOCUMENT ID	TECN	COMMENT
0.79±0.28	ABLIKIM	20W BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R18
 NODE=M176R18

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻³ (CL = 90%)	[<9 × 10 ⁻³ (CL = 90%) OUR 2023 BEST LIMIT]			
<8 × 10⁻³	90	¹ BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c1}\gamma K^\pm$
¹ BHARDWAJ 13 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)]$ < 1.9 × 10 ⁻⁶ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R08
 NODE=M176R08

NODE=M176R08;LINKAGE=B

 $\Gamma(\gamma\chi_{c1})/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{25}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.89	90	CHOI	03 BELL	$B \rightarrow K\pi^+\pi^- J/\psi$

NODE=M176R1
 NODE=M176R1

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.029 (CL = 90%)	[<0.032 (CL = 90%) OUR 2023 BEST LIMIT]			
<0.029	90	¹ BHARDWAJ 13	BELL	$B^\pm \rightarrow \chi_{c2}\gamma K^\pm$
¹ BHARDWAJ 13 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\chi_{c2})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)]$ < 6.7 × 10 ⁻⁶ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.				

NODE=M176R01
 NODE=M176R01

NODE=M176R01;LINKAGE=B

 $\Gamma(\gamma\psi(2S))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	[>0.04 OUR 2020 BEST LIMIT]			
possibly seen	36 ± 9	¹ AAIJ	14AH LHCb	$B^+ \rightarrow \gamma\psi(2S)K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		² BHARDWAJ 11	BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$
0.042 ± 0.012 ± 0.011	25 ± 7	³ AUBERT	09B BABR	$B^+ \rightarrow \gamma\psi(2S)K^+$

NODE=M176R10
 NODE=M176R10

NODE=M176R10;LINKAGE=A

NODE=M176R10;LINKAGE=BH

NODE=M176R10;LINKAGE=AU

¹ From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ.
² BHARDWAJ 11 reports $B(B^+ \rightarrow K^+\chi_{c1}(3872)) \times B(\chi_{c1} \rightarrow \gamma\psi(2S)) < 3.45 \times 10^{-6}$ at 90% CL.
³ AUBERT 09B reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\psi(2S))/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] = (9.5 \pm 2.7 \pm 0.6) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.3 \pm 0.6) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\gamma\psi(2S))/\Gamma(\pi^+\pi^- J/\psi(1S))$ Γ_{27}/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42	90	ABLIKIM	20W BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

NODE=M176R19
 NODE=M176R19

 $\Gamma(\gamma\psi(2S))/\Gamma(\gamma J/\psi)$ Γ_{27}/Γ_{24}

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.59	90		ABLIKIM	20W BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
2.46 ± 0.64 ± 0.29	36 ± 9	¹ AAIJ	14AH LHCb		$B^+ \rightarrow \gamma\psi(2S)K^+$
<2.1	90	BHARDWAJ 11	BELL		$B^+ \rightarrow \gamma\psi(2S)K^+$
3.4 ± 1.4		AUBERT	09B BABR		$B^+ \rightarrow \gamma c\bar{c}K'$

NODE=M176R11
 NODE=M176R11

¹ From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ.

NODE=M176R11;LINKAGE=A

C-violating decays

NODE=M176405

 $\Gamma(\eta J/\psi)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.017 (CL = 90%)	[<0.018 (CL = 90%) OUR 2023 BEST LIMIT]			
<0.017	90	^{1,2} IWASHITA 14	BELL	$B \rightarrow K\eta J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.034	90	³ AUBERT	04Y BABR	$B \rightarrow K\eta J/\psi$

NODE=M176R2
 NODE=M176R2

¹ IWASHITA 14 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \eta J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 3.8 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.
² IWASHITA 14 also scans the $\eta J/\psi$ mass range 3.8–4.75 GeV and sets upper limits for $B(B^\pm \rightarrow \chi_{c1}(3872)K^\pm) \times B(\chi_{c1}(3872) \rightarrow \eta J/\psi)$ in 5 MeV intervals.
³ AUBERT 04Y reports $[\Gamma(\chi_{c1}(3872) \rightarrow \eta J/\psi)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 7.7 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.3 \times 10^{-4}$.

NODE=M176R2;LINKAGE=A

NODE=M176R2;LINKAGE=C

NODE=M176R2;LINKAGE=D

$\chi_{c1}(3872)$ REFERENCES

NODE=M176

AAIJ	23AP	JHEP 2307 084	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62412
AAIJ	23S	PR D108 L011103	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62287
ABLIKIM	23O	PR D107 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62058
ABLIKIM	23W	PRL 130 151904	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62068
HIRATA	23	PR D107 112011	H. Hirata <i>et al.</i>	(BELLE Collab.)	REFID=62281
YIN	23	PR D107 052004	J.H. Yin <i>et al.</i>	(BELLE Collab.)	REFID=61909
ABLIKIM	22D	PR D105 072009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61638
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)	REFID=61634
TERAMOTO	21	PRL 126 122001	Y. Teramoto <i>et al.</i>	(BELLE Collab.)	REFID=61098
AAIJ	20AD	PR D102 092005	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60673
AAIJ	20S	JHEP 2008 123	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60526
ABLIKIM	20W	PRL 124 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60570
LEES	20C	PRL 124 152001	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=60554
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)	REFID=60676
ABLIKIM	19U	PRL 122 202001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59786
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59796
BHARDWAJ	19	PR D99 111101	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=59884
AGHASYAN	18A	PL B783 334	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)	REFID=59036
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=58191
BHARDWAJ	16	PR D93 052016	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=57272
AAIJ	15AO	PR D92 011102	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=56771
ABLIKIM	15V	PL B749 414	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56787
BALA	15	PR D91 051101	A. Bala <i>et al.</i>	(BELLE Collab.)	REFID=56408
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)	REFID=56706
Also		JHEP 1702 088 (errat.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)	REFID=57795
AAIJ	14AH	NP B886 665	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55897
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55647
IWASHITA	14	PTEP 2014 043C01	T. Iwashita <i>et al.</i>	(BELLE Collab.)	REFID=55925
AAIJ	13Q	PRL 110 222001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=54985
AAIJ	13S	EPJ C73 2462	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55008
BHARDWAJ	13	PRL 111 032001	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=55412
AAIJ	12H	EPJ C72 1972	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54056
LEES	12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54751
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54752
BHARDWAJ	11	PRL 107 091803	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)	REFID=53779
CHOI	11	PR D84 052004	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=53934
WANG	11B	PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=53939
AUSHEV	10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)	REFID=53225
DEL-AMO-SA...	10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53362
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AALTONEN	09AU	PRL 103 152001	T. Aaltonen <i>et al.</i>	(CDF Collab.)	REFID=53098
AUBERT	09B	PRL 102 132001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52722
AUBERT	08B	PR D77 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52120
AUBERT	08Y	PR D77 111101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52265
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)	REFID=52204
AUBERT	06	PR D73 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51017
AUBERT,BE	06M	PR D74 071101	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51454
GOKHROO	06	PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)	REFID=51432
AUBERT	05B	PR D71 031501	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50498
AUBERT	05D	PR D71 052001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50509
AUBERT	05R	PR D71 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50627
DOBBS	05	PRL 94 032004	S. Dobbs <i>et al.</i>	(CLEO Collab.)	REFID=50458
ABAZOV	04F	PRL 93 162002	V.M. Abazov <i>et al.</i>	(D0 Collab.)	REFID=50200
ACOSTA	04	PRL 93 072001	D. Acosta <i>et al.</i>	(CDF Collab.)	REFID=49742
AUBERT	04Y	PRL 93 041801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=49997
CHISTOV	04	PRL 93 051803	R. Chistov <i>et al.</i>	(BELLE Collab.)	REFID=50002
PDG	04	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
YUAN	04	PL B579 74	C.Z. Yuan <i>et al.</i>		REFID=49677
CHOI	03	PRL 91 262001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)	REFID=49628
BAI	98E	PR D57 3854	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46339
ANTONIAZZI	94	PR D50 4258	L. Antoniazzi <i>et al.</i>	(E705 Collab.)	REFID=44074

NODE=M159

$\chi_{c0}(3915)$

$I^G(J^{PC}) = 0^+(0^{++})$

was $X(3915)$

The $\chi_{c0}(3915)$ was originally seen by BELLE in its $\omega J/\psi$ decay mode and was produced in both B decays in CHOI 05 and $\gamma\gamma$ collisions in UEHARA 10. The J^{PC} was determined to be 0^{++} by BABAR in LEES 12AD but this assignment was questioned by ZHOU 15C. In AAIJ 20AI LHCb found the $D^+ D^-$ decay mode of the $\chi_{c0}(3915)$ using B decays and determined its J^{PC} to be 0^{++} . Based on their compatible mass, width, and J^{PC} , we assume the state decaying to $\omega J/\psi$ and the state decaying to $D^+ D^-$ are both the $\chi_{c0}(3915)$. See also the $\chi_{c2}(3930)$.

NODE=M159

$\chi_{c0}(3915)$ MASS

NODE=M159M

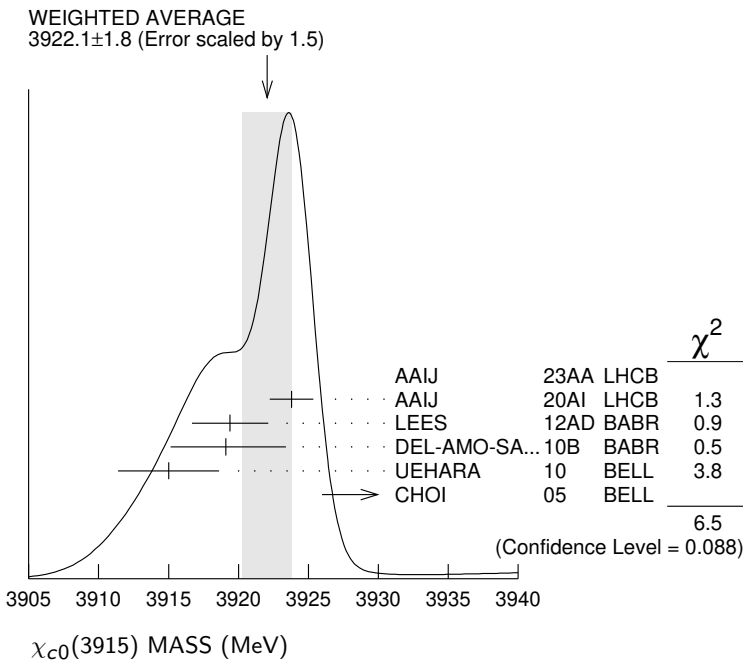
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3922.1± 1.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
[3921.7 ± 1.8 MeV OUR 2023 AVERAGE Scale factor = 1.5]				
3956 ± 5 ± 10	360	¹ AAIJ	23AA LHCb	$B^+ \rightarrow D_s^+ D_s^- K^+$
3923.8± 1.5± 0.4	1.2k	² AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
3919.4± 2.2± 1.6	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
3919.1 ⁺ _{− 3.4} ± 3.8± 2.0		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
3943 ±11 ±13	58 ± 11	³ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3922.4± 6.5± 2.0		⁴ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$
3926.4± 2.2± 1.2		⁵ ABLIKIM	19v BES	$e^+ e^- \rightarrow \gamma\omega J/\psi$
3914.6 ⁺ _{− 3.4} ± 3.8± 2.0		³ AUBERT	08w BABR	Superseded by DEL-AMO-SANCHEZ 10B

NODE=M159M
NEW

- ¹ $D_s^+ D_s^-$ near-threshold enhancement parameterized with a Flatte-like function .
- ² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape.
- ³ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.
- ⁴ Not distinguished from the $\chi_{c2}(3930)$.
- ⁵ Could also be $X(3940)$. Significance 3.1σ . Fit with additional resonance at 3963.7 ± 5.7 MeV, significance 3.4σ .

NODE=M159M;LINKAGE=D
NODE=M159M;LINKAGE=B

NODE=M159M;LINKAGE=CH
NODE=M159M;LINKAGE=C
NODE=M159M;LINKAGE=A



$\chi_{c0}(3915)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ± 4 OUR AVERAGE		Error includes scale factor of 1.1. [18.8 ± 3.5 MeV OUR 2023 AVERAGE]		
43 ±13 ± 8	360	¹ AAIJ	23AA LHCb	$B^+ \rightarrow D_s^+ D_s^- K^+$
17.4 ± 5.1 ± 0.8	1.2k	² AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
13 ± 6 ± 3	59	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
31 $^{+10}_{-8}$ ± 5		DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$
17 ±10 ± 3	49	UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
87 ±22 ±26	58	³ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22 ±17 ± 4		⁴ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$
3.8 ± 7.5 ± 2.6		⁵ ABLIKIM	19V BES	$e^+ e^- \rightarrow \gamma\omega J/\psi$
34 $^{+12}_{-8}$ ± 5		³ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

¹ $D_s^+ D_s^-$ near-threshold enhancement parameterized with a Flatté-like function .

² Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape.

³ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.

⁴ Not distinguished from the $\chi_{c2}(3930)$.

⁵ Could also be $X(3940)$. Significance 3.1σ . Fit with additional resonance at 3963.7 ± 5.7 MeV, significance 3.4σ .

NODE=M159W

NODE=M159W

NEW

NODE=M159W;LINKAGE=D
NODE=M159W;LINKAGE=BNODE=M159W;LINKAGE=CH
NODE=M159W;LINKAGE=C
NODE=M159W;LINKAGE=A $\chi_{c0}(3915)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	not seen
Γ_3 $D^+ D^-$	seen
Γ_4 $D_s^+ D_s^-$	seen
Γ_5 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_6 $\eta_c \eta$	not seen
Γ_7 $\eta_c \pi^0$	not seen
Γ_8 $K \bar{K}$	not seen
Γ_9 $\gamma\gamma$	seen
Γ_{10} $\gamma\psi(2S)$	not seen
Γ_{11} $\pi^0 \chi_{c1}$	not seen

NODE=M159215;NODE=M159

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=9
DESIG=11;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=2
DESIG=10;OUR EST;→ UNCHECKED ←
DESIG=8 $\chi_{c0}(3915)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_9/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
54± 9 OUR AVERAGE					
52±10±3	59 ± 10	¹ LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$	
61±17±8	49 ± 15	¹ UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
18± 5±2	49 ± 15	² UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$	
¹ For $J^P = 0^+$.					
² For $J^P = 2^+$, helicity-2.					

NODE=M159220

NODE=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UH
NODE=M159G01;LINKAGE=UR

$\Gamma(\gamma\psi(2S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_9/\Gamma$		
<u>VALUE (eV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$9.8 \pm 3.6 \pm 1.3$	¹ WANG	22A BELL	$\gamma\gamma \rightarrow \gamma\psi(2S)$
¹ Not distinguished from the $\chi_{c2}(3930)$.			

NODE=M159R07
NODE=M159R07

NODE=M159R07;LINKAGE=A

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_9/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<16	90	LEES	12AE BABR	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$	

NODE=M159G02
NODE=M159G02

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_8\Gamma_9/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.96	90	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M159G03
NODE=M159G03

$\chi_{c0}(3915)$ BRANCHING RATIOS

NODE=M159225

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		¹ DEL-AMO-SA...10B	BABR	$B \rightarrow \omega J/\psi K$	
seen		² CHOI	05	BELL	$B \rightarrow \omega J/\psi K$

NODE=M159R03
NODE=M159R03

¹ DEL-AMO-SANCHEZ 10B reports $B(B^{\pm} \rightarrow \chi_{c0}(3915) K^{\pm}) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega)$
 $= (3.0^{+0.7+0.5}_{-0.6-0.3}) \times 10^{-5}$ and $B(B^0 \rightarrow \chi_{c0}(3915) K^0) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega)$
 $= (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.

NODE=M159R03;LINKAGE=DE

² CHOI 05 reports $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow J/\psi \omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.

NODE=M159R03;LINKAGE=CH

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0} D^0)$					Γ_1/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
>0.71	90	¹ AUSHEV	10	BELL	$B \rightarrow \bar{D}^{*0} D^0 K$

NODE=M159R02
NODE=M159R02

¹ By combining the upper limit $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow D^{*0} \bar{D}^0)$
 $< 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08w
measurements $B(B \rightarrow \chi_{c0}(3915) K) \times B(\chi_{c0}(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.

NODE=M159R02;LINKAGE=AU

$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		AAIJ	20AI	LHCB	$B^+ \rightarrow D^+ D^- K^+$

NODE=M159R06
NODE=M159R06

$\Gamma(D^+ D^-)/\Gamma(D_s^+ D_s^-)$					Γ_3/Γ_4
VALUE		DOCUMENT ID	TECN	COMMENT	
$0.29 \pm 0.09 \pm 0.10 \pm 0.08$		¹ AAIJ	23AA	LHCB	$B^+ \rightarrow D_s^+ D_s^- K^+$

NODE=M159R08
NODE=M159R08

¹ Assuming that AAIJ 20AI reporting on $B^+ \rightarrow D^+ D^- K^+$ also refers to $\chi_{c0}(3915)$.
The last uncertainty is due to the values of $B(D^+ \rightarrow K^- \pi^+ \pi^+)$ and $B(D_s^+ \rightarrow K^- K^+ \pi^+)$ from PDG 22.

NODE=M159R08;LINKAGE=A

$\Gamma(\eta_c \eta)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
not seen	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \eta$	

NODE=M159R00
NODE=M159R00

OCCUR=2

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)) \times B(\chi_{c0}(3915) \rightarrow \eta_c \eta) < 4.7 \times 10^{-5}$ at 90% CL.

NODE=M159R00;LINKAGE=A

$\Gamma(\eta_c \pi^0)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
not seen	90	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^0$	

NODE=M159R04
NODE=M159R04

OCCUR=2

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)^0) \times B(\chi_{c0}(3915) \rightarrow \eta_c \pi^0) < 1.7 \times 10^{-5}$ at 90% CL.

NODE=M159R04;LINKAGE=A

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_9/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	59 ± 10	LEES	12AD	BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
seen		UEHARA	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$

NODE=M159R01
NODE=M159R01

$\Gamma(\pi^0 \chi_{c1})/\Gamma_{\text{total}}$					Γ_{11}/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
not seen	42 ± 14	¹ BHARDWAJ	19	BELL	$B^{\pm} \rightarrow \chi_{c1} \pi^0 K^{\pm}$

NODE=M159R05
NODE=M159R05

¹ BHARDWAJ 19 reports $B(B^+ \rightarrow K^+ \chi_{c0}(3915)) \times B(\chi_{c0}(3915) \rightarrow \chi_{c1} \pi^0) < 3.8 \times 10^{-5}$ at 90% CL. A signal significance 2.3 standard deviations.

NODE=M159R05;LINKAGE=A

$\chi_{c0}(3915)$ REFERENCES

AAIJ	23AA	PRL 131 071901	R. Aaij <i>et al.</i>	(LHCb Collab.)
PDG	22	PTEP 2022 083C01	R.L. Workman <i>et al.</i>	(PDG Collab.)
WANG	22A	PR D105 112011	X.L. Wang <i>et al.</i>	(BELLE Collab.)
AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.) JPC
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
BHARDWAJ	19	PR D99 111101	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
Also		JHEP 1702 088 (errat.)	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
ZHOU	15C	PRL 115 022001	Z.-Y. Zhou, Z. Xiao, H.-Q. Zhou	(BEIJT, NANJ)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
LEES	12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUSHEV	10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
UEHARA	10	PRL 104 092001	S. Uehara <i>et al.</i>	(BELLE Collab.)
AUBERT	08W	PRL 101 082001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHOI	05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

NODE=M159

REFID=62314
REFID=61634
REFID=61640
REFID=60739
REFID=59796
REFID=59884
REFID=56706
REFID=57795
REFID=56842
REFID=55592
REFID=54751
REFID=54752
REFID=53225
REFID=53362
REFID=53232
REFID=52263
REFID=50737

 $\chi_{c2}(3930)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M050

 $\chi_{c2}(3930)$ MASS

NODE=M050M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3922.5 ± 1.0 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
3926.8 ± 2.4 ± 0.8	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
3921.9 ± 0.6 ± 0.2		² AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
3926.7 ± 2.7 ± 1.1	76 ± 17	AUBERT	10G BABR	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$
3929 ± 5 ± 2	64	UEHARA	06 BELL	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$

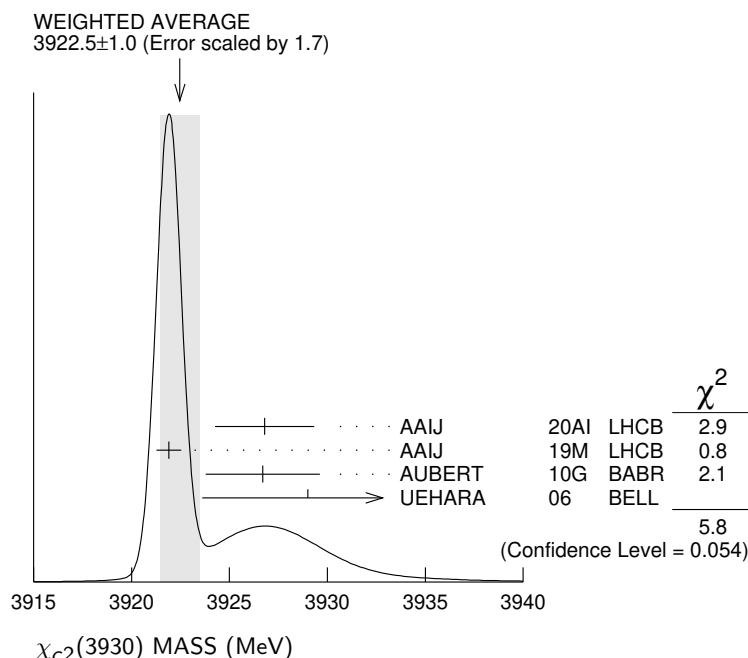
NODE=M050M

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Previous measurements assumed a single state in this region. This analysis revealed the presence of $\chi_{c0}(3930)$ with the same mass.

NODE=M050M;LINKAGE=B

² Measured in prompt hadroproduction.

NODE=M050M;LINKAGE=A

 $\chi_{c2}(3930)$ WIDTH

NODE=M050W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
35.2 ± 2.2 OUR AVERAGE		Error includes scale factor of 1.2.		
34.2 ± 6.6 ± 1.1	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$
36.6 ± 1.9 ± 0.9		² AAIJ	19M LHCb	$pp \rightarrow D\bar{D} + \text{anything}$
21.3 ± 6.8 ± 3.6	76 ± 17	AUBERT	10G BABR	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$
29 ± 10 ± 2	64	UEHARA	06 BELL	10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$

NODE=M050W

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Previous measurements assumed a single state in this region. This analysis revealed the presence of $\chi_{c0}(3930)$ with the same mass.

NODE=M050W;LINKAGE=B

² Measured in prompt hadroproduction.

NODE=M050W;LINKAGE=A

χ_{c2}(3930) DECAY MODES

NODE=M050215;NODE=M050

Mode		Fraction (Γ _i /Γ)
Γ ₁	γγ	seen
Γ ₂	K ⁺ K ⁻ π	not seen
Γ ₃	K ⁺ K ⁻ π ⁺ π ⁻ π ⁰	not seen
Γ ₄	D ⁺ D ⁻	seen
Γ ₅	D ⁰ D ⁰	seen
Γ ₆	D ⁰ D ⁰	seen
Γ ₇	π ⁺ π ⁻ η _c (1S)	not seen
Γ ₈	K ⁺ K ⁻	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=7;OUR EVAL;→ UNCHECKED ←
DESIG=8;OUR EVAL;→ UNCHECKED ←

χ_{c2}(3930) PARTIAL WIDTHS

NODE=M050220

χ_{c2}(3930) Γ(i)Γ(γγ)/Γ(total)

NODE=M050222

Γ(K ⁺ K ⁻ π) × Γ(γγ)/Γ _{total}		Γ ₂ Γ ₁ /Γ		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	DEL-AMO-SA..11M	BABR	γγ → K _S ⁰ K [±] π [∓]

NODE=M050G01
NODE=M050G01

Γ(K ⁺ K ⁻ π ⁺ π ⁻ π ⁰) × Γ(γγ)/Γ _{total}		Γ ₃ Γ ₁ /Γ		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.4	90	DEL-AMO-SA..11M	BABR	γγ → K ⁺ K ⁻ π ⁺ π ⁻ π ⁰

NODE=M050G02
NODE=M050G02

Γ(D ⁺ D ⁻) × Γ(γγ)/Γ _{total}		Γ ₄ Γ ₁ /Γ		
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.21±0.04 OUR AVERAGE				
0.24±0.05±0.04	76 ± 17	AUBERT	10G	BABR 10.6 e ⁺ e ⁻ → e ⁺ e ⁻ D ⁺ D ⁻
0.18±0.05±0.03	64	¹ UEHARA	06	BELL 10.6 e ⁺ e ⁻ → e ⁺ e ⁻ D ⁰ D ⁰
¹ Assuming B(D ⁺ D ⁻) = 0.89 B(D ⁰ D ⁰).				

NODE=M050G1
NODE=M050G1

NODE=M050G1;LINKAGE=UE

Γ(π ⁺ π ⁻ η _c (1S)) × Γ(γγ)/Γ _{total}		Γ ₇ Γ ₁ /Γ		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<18	90	LEES	12AE	BABR e ⁺ e ⁻ → e ⁺ e ⁻ π ⁺ π ⁻ η _c

NODE=M050G03
NODE=M050G03

Γ(K ⁺ K ⁻) × Γ(γγ)/Γ _{total}		Γ ₈ Γ ₁ /Γ		
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.256	90	UEHARA	13	BELL γγ → K _S ⁰ K _S ⁰

NODE=M050G04
NODE=M050G04

χ_{c2}(3930) BRANCHING RATIOS

NODE=M050225

Γ(D ⁺ D ⁻)/Γ(D ⁰ D ⁰)		Γ ₅ /Γ ₆		
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.74±0.43±0.16	64	UEHARA	06	BELL 10.6 e ⁺ e ⁻ → e ⁺ e ⁻ D ⁺ D ⁻

NODE=M050R01
NODE=M050R01

χ_{c2}(3930) REFERENCES

NODE=M050

AAIJ	20AI	PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	10G	PR D81 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	06	PRL 96 082003	S. Uehara <i>et al.</i>	(BELLE Collab.)

REFID=60739
REFID=59697
REFID=55592
REFID=54752
REFID=16751
REFID=53357
REFID=51039

X(3940)

$$I^G(J^{PC}) = ?^?(?^{??})$$

OMITTED FROM SUMMARY TABLE

Reported by ABE 07, observed in $e^+e^- \rightarrow J/\psi X$.**X(3940) MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$3942^{+7}_{-6} \pm 6$	52	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3943 \pm 6 \pm 6$	25	¹ ABE	07	BELL $e^+e^- \rightarrow J/\psi X$
3936 ± 14	266	² ABE	07	BELL $e^+e^- \rightarrow J/\psi(c\bar{c})$
¹ From a fit to $D^{*+}D^-$ and $D^{*0}\bar{D}^0$ events.				
² From the inclusive fit. Not independent of the exclusive measurement by ABE 07.				

X(3940) WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$37^{+26}_{-15} \pm 8$		52	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<52	90	25	ABE	07	BELL $e^+e^- \rightarrow J/\psi X$

X(3940) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}^* + \text{c.c.}$	seen
Γ_2 $D\bar{D}$	not seen
Γ_3 $J/\psi\omega$	not seen

X(3940) BRANCHING RATIOS **$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>0.45	90	25	^{1,2} ABE	07	BELL $e^+e^- \rightarrow J/\psi X$
¹ For X(3940) decaying to final states with more than two tracks.					
² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c ² may consist of several states.					

 $\Gamma(D\bar{D})/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.41	90	^{1,2} ABE	07	BELL $e^+e^- \rightarrow J/\psi X$
¹ For X(3940) decaying to final states with more than two tracks.				
² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c ² may consist of several states.				

 $\Gamma(J/\psi\omega)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.26	90	^{1,2} ABE	07	BELL $e^+e^- \rightarrow J/\psi X$
¹ For X(3940) decaying to final states with more than two tracks.				
² PAKHLOV 08 finds that the inclusive peak near 3940 MeV/c ² may consist of several states.				

X(3940) REFERENCES

PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)

NODE=M029

NODE=M029

NODE=M029M

NODE=M029M

OCCUR=2

NODE=M029M;LINKAGE=EB

NODE=M029M;LINKAGE=EM

NODE=M029W

NODE=M029W

NODE=M029215;NODE=M029

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

NODE=M029225

NODE=M029R01

NODE=M029R01

NODE=M029R01;LINKAGE=AB

NODE=M029R01;LINKAGE=AE

NODE=M029R02

NODE=M029R02

NODE=M029R02;LINKAGE=AB

NODE=M029R02;LINKAGE=AE

NODE=M029R03

NODE=M029R03

NODE=M029R03;LINKAGE=AB

NODE=M029R03;LINKAGE=AE

NODE=M029

REFID=52302

REFID=51627

$\psi(4040)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M072

 $\psi(4040)$ MASS

NODE=M072M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4039.6 ± 4.3	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4034 ± 6	² MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
4037 ± 2	³ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4040 ± 1	⁴ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
4040 ± 10	BRANDELIK	78C DASP	e^+e^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁴ From a fit to BES (BAI 02C) data.			

NODE=M072M

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST
NODE=M072M;LINKAGE=SE **$\psi(4040)$ WIDTH**

NODE=M072W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
84.5 ± 12.3	⁵ ABLIKIM	08D BES2	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
87 ± 11	⁶ MO	10 RVUE	$e^+e^- \rightarrow$ hadrons
85 ± 10	⁷ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
89 ± 6	⁸ SETH	05A RVUE	$e^+e^- \rightarrow$ hadrons
52 ± 10	BRANDELIK	78C DASP	e^+e^-
⁵ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.			
⁶ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁷ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁸ From a fit to BES (BAI 02C) data.			

NODE=M072W

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST
NODE=M072W;LINKAGE=SE **$\psi(4040)$ DECAY MODES**

NODE=M072215;NODE=M072

NODE=M072

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(1.02 \pm 0.17) \times 10^{-5}$	DESIG=5
Γ_2 $D\bar{D}$	seen	DESIG=17;OUR EST;→ UNCHECKED ←
Γ_3 $D^0\bar{D}^0$	seen	DESIG=1
Γ_4 D^+D^-	seen	DESIG=18
Γ_5 $D^*\bar{D} + \text{c.c.}$	seen	DESIG=19;OUR EST;→ UNCHECKED ←
Γ_6 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	DESIG=2
Γ_7 $D^*(2010)^+D^- + \text{c.c.}$	seen	DESIG=20
Γ_8 $D^*\bar{D}^*$	seen	DESIG=21;OUR EST;→ UNCHECKED ←
Γ_9 $D^*(2007)^0\bar{D}^*(2007)^0$	seen	DESIG=3
Γ_{10} $D^*(2010)^+D^*(2010)^-$	seen	DESIG=22
Γ_{11} $D\bar{D}\pi$ (excl. $D^*\bar{D}$)	not seen	DESIG=23;OUR EST;→ UNCHECKED ←
Γ_{12} $D^0D^-\pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+D^- + \text{c.c.}$)	not seen	DESIG=24
Γ_{13} $D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	DESIG=25
Γ_{14} $D^0\bar{D}^*\pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+D^*(2010)^-$)	seen	DESIG=26

Γ_{15}	$D^+ D_s^-$	seen		
Γ_{16}	$\pi^+ \pi^- \pi^+ \pi^- \pi^0$	seen		
Γ_{17}	$J/\psi(1S)$ hadrons	seen		
Γ_{18}	$J/\psi \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%
Γ_{19}	$J/\psi \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%
Γ_{20}	$J/\psi \eta$	(5.2 ± 0.7)	$\times 10^{-3}$	
Γ_{21}	$J/\psi \pi^0$	< 2.8	$\times 10^{-4}$	90%
Γ_{22}	$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%
Γ_{23}	$\chi_{c1} \gamma$	< 3.4	$\times 10^{-3}$	90%
Γ_{24}	$\chi_{c2} \gamma$	< 5	$\times 10^{-3}$	90%
Γ_{25}	$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%
Γ_{26}	$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%
Γ_{27}	$h_c(1P) \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%
Γ_{28}	$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%
Γ_{29}	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	< 2.9	$\times 10^{-4}$	90%
Γ_{30}	$\Lambda \bar{\Lambda} \pi^0$	< 9	$\times 10^{-5}$	90%
Γ_{31}	$\Lambda \bar{\Lambda} \eta$	< 3.0	$\times 10^{-4}$	90%
Γ_{32}	$\Lambda \bar{\Lambda}$	< 6	$\times 10^{-6}$	90%
Γ_{33}	$\Sigma^+ \bar{\Sigma}^-$	< 1.3	$\times 10^{-4}$	90%
Γ_{34}	$\Sigma^0 \bar{\Sigma}^0$	< 7	$\times 10^{-5}$	90%
Γ_{35}	$\Xi^+ \bar{\Xi}^-$	< 1.6	$\times 10^{-4}$	90%
Γ_{36}	$\Xi^0 \bar{\Xi}^0$	< 1.8	$\times 10^{-4}$	90%
Γ_{37}	$\Xi^- \bar{\Xi}^+$	< 6	$\times 10^{-5}$	90%
Γ_{38}	$\mu^+ \mu^-$	(9 ± 6)	$\times 10^{-6}$	

DESIG=27

DESIG=37;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=28

DESIG=16

DESIG=29

DESIG=30

DESIG=31

DESIG=36

DESIG=32

DESIG=33

DESIG=34

DESIG=35

DESIG=38

DESIG=6

 $\psi(4040)$ PARTIAL WIDTHS

NODE=M072220

 $\Gamma(e^+ e^-)$ **Γ_1**

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

 0.86 ± 0.07 OUR ESTIMATE **0.83 ± 0.20** ⁹ ABLIKIM

08D

BES2

 $e^+ e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 to 1.4

¹⁰ MO

10

RVUE

 $e^+ e^- \rightarrow$ hadrons 0.88 ± 0.11 ¹¹ SETH

05A

RVUE

 $e^+ e^- \rightarrow$ hadrons 0.91 ± 0.13 ¹² SETH

05A

RVUE

 $e^+ e^- \rightarrow$ hadrons 0.75 ± 0.15

BRANDELIK

78C

DASP

 $e^+ e^-$

OCCUR=2

⁹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (130 \pm 46)^\circ$.

¹⁰ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

¹¹ From a fit to Crystal Ball (OSTERHELD 86) data.

¹² From a fit to BES (BAI 02C) data.

NODE=M072W5;LINKAGE=AB

NODE=M072W5;LINKAGE=MO

NODE=M072W5;LINKAGE=ST

NODE=M072W5;LINKAGE=SE

 $\Gamma(\mu^+ \mu^-)$ **Γ_{38}**

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

 $0.73 \pm 0.48 \pm 0.12$ ^{13,14} ABLIKIM

20AG

BES3

 $e^+ e^- \rightarrow \mu^+ \mu^-$

¹³ From a fit to the $e^+ e^- \rightarrow \mu^+ \mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$.

¹⁴ From solution 1 of 8 with equal fit quality. Other solutions range from $0.58 \pm 0.52 \pm 0.10$ to $0.80 \pm 0.48 \pm 0.13$ keV.

NODE=M072W2

NODE=M072W2

NODE=M072W2;LINKAGE=A

NODE=M072W2;LINKAGE=B

 $\psi(4040) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M072235

 $\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{20} \Gamma_1 / \Gamma$**

VALUE (eV)

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

 1.5 ± 0.3 ¹⁵ ABLIKIM

200

BES3

 $e^+ e^- \rightarrow \eta J/\psi$ 1.4 ± 0.3 ¹⁶ ABLIKIM

200

BES3

 $e^+ e^- \rightarrow \eta J/\psi$ 7.0 ± 0.6 ¹⁷ ABLIKIM

200

BES3

 $e^+ e^- \rightarrow \eta J/\psi$

OCCUR=2

OCCUR=3

¹⁵ Solution 1 of three equivalent fit solutions using three resonant structures.

¹⁶ Solution 2 of three equivalent fit solutions using three resonant structures.

¹⁷ Solution 3 of three equivalent fit solutions using three resonant structures.

NODE=M072R00;LINKAGE=A

NODE=M072R00;LINKAGE=B

NODE=M072R00;LINKAGE=C

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{23}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<2.9	90	¹⁸ HAN	15	BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$
¹⁸ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.					

NODE=M072G01
NODE=M072G01

NODE=M072G01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{24}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<4.6	90	¹⁹ HAN	15	BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$
¹⁹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.					

NODE=M072G02
NODE=M072G02

NODE=M072G02;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{32}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<5.5 × 10⁻³	90	²⁰ ABLIKIM	21AS	BES3	$e^+e^- \rightarrow \psi(4040)$
²⁰ From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.					

NODE=M072R33
NODE=M072R33

NODE=M072R33;LINKAGE=A

$\Gamma(\Xi^-\Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{37}\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.0519	90	²¹ ABLIKIM	23BK	BES3	$e^+e^- \rightarrow \psi(4040)$
²¹ From a fit to $e^+e^- \rightarrow \Xi^-\Xi^+$ cross sections.					

NODE=M072R35
NODE=M072R35

NODE=M072R35;LINKAGE=A

$\psi(4040) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M072230

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{20}/\Gamma \times \Gamma_1/\Gamma$
VALUE (units 10 ⁻⁸)		DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5.1 ± 1.4 ± 1.5		²² WANG	13B	BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$
12.8 ± 2.1 ± 1.9		²³ WANG	13B	BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$
²² Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.					
²³ Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.					

NODE=M072R25
NODE=M072R25

OCCUR=2

NODE=M072R25;LINKAGE=A

NODE=M072R25;LINKAGE=B

$\psi(4040)$ BRANCHING RATIOS

NODE=M072225

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE (units 10 ⁻⁵)		DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1.0		FELDMAN	77	MRK1	e^+e^-

NODE=M072R4
NODE=M072R4

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		AUBERT	09M	BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
seen		CRONIN-HEN..09	CLEO		$e^+e^- \rightarrow D^0\bar{D}^0$
seen		PAKHLOVA	08	BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M072R14
NODE=M072R14

$\Gamma(D^+D^-)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		AUBERT	09M	BABR	$e^+e^- \rightarrow D^+D^-\gamma$
seen		CRONIN-HEN..09	CLEO		$e^+e^- \rightarrow D^+D^-$
seen		PAKHLOVA	08	BELL	$e^+e^- \rightarrow D^+D^-\gamma$

NODE=M072R15
NODE=M072R15

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D} + \text{c.c.})$					Γ_2/Γ_5
VALUE		DOCUMENT ID	TECN	COMMENT	
0.24 ± 0.05 ± 0.12		AUBERT	09M	BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}$

NODE=M072R12
NODE=M072R12

$\Gamma(D^0\bar{D}^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$					Γ_3/Γ_6
VALUE		DOCUMENT ID	TECN	COMMENT	
0.05 ± 0.03		²⁴ GOLDBABER	77	MRK1	e^+e^-
²⁴ Phase-space factor (p^3) explicitly removed.					

NODE=M072R1
NODE=M072R1

NODE=M072R;LINKAGE=P

$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		AUBERT	09M	BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$
seen		CRONIN-HEN..09	CLEO		$e^+e^- \rightarrow D^{*0}\bar{D}^0$

NODE=M072R16
NODE=M072R16

$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	²⁵ ZHUKOVA 18	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
²⁵ Supersedes PAKHLOVA 07.			

NODE=M072R17
 NODE=M072R17
 OCCUR=3

NODE=M072R17;LINKAGE=C

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
0.95 ± 0.09 ± 0.10	AUBERT 09M	BABR	$e^+ e^- \rightarrow \gamma D^* \bar{D}$

NODE=M072R11
 NODE=M072R11

 $\Gamma(D^* \bar{D}^*)/\Gamma(D^* \bar{D} + \text{c.c.})$ Γ_8/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT
0.18 ± 0.14 ± 0.03	AUBERT 09M	BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M072R13
 NODE=M072R13

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$

NODE=M072R18
 NODE=M072R18

 $\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})$ Γ_9/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT
32.0 ± 12.0	²⁶ GOLDBABER 77	MRK1	$e^+ e^-$

NODE=M072R2
 NODE=M072R2

²⁶ Phase-space factor (p^3) explicitly removed.

NODE=M072R2;LINKAGE=P

 $\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	²⁷ ZHUKOVA 18	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
²⁷ Supersedes PAKHLOVA 07.			

NODE=M072R19
 NODE=M072R19
 OCCUR=2

NODE=M072R19;LINKAGE=B

 $\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M072R20
 NODE=M072R20

 $\Gamma(D \bar{D}^* \pi (\text{excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M072R21
 NODE=M072R21

 $\Gamma(D^0 \bar{D}^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 \bar{D}^{*-} \pi^+ \gamma$

NODE=M072R22
 NODE=M072R22

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

NODE=M072R23
 NODE=M072R23

 $\Gamma(\pi^+ \pi^+ \pi^- \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(3.51 \pm 1.89 \pm 1.24) \times 10^{-5}$	²⁸ ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow 2\pi^+ 2\pi^- \pi^0$
$(2.41 \pm 0.05 \pm 0.79) \times 10^{-2}$	²⁹ ABLIKIM 21AW	BES3	$e^+ e^- \rightarrow 2\pi^+ 2\pi^- \pi^0$

NODE=M072R34
 NODE=M072R34

OCCUR=2

²⁸ Solution 1 of two solutions with equal fit quality. The significance of the $\psi(4040)$ signal is 3.6 σ .

NODE=M072R34;LINKAGE=A

²⁹ Solution 2 of two solutions with equal fit quality. The significance of the $\psi(4040)$ signal is 3.6 σ .

NODE=M072R34;LINKAGE=B

$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R01
NODE=M072R01

 $\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R02
NODE=M072R02

 $\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
$5.2 \pm 0.5 \pm 0.5$		³⁰ ABLIKIM 12K	BES3	$e^+e^- \rightarrow \ell^+\ell^- 2\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<7	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

³⁰ ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\eta) = 32.1 \pm 2.8 \pm 1.3$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R03
NODE=M072R03

NODE=M072R03;LINKAGE=AB

 $\Gamma(J/\psi\pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	³¹ ABLIKIM 12K	BES3	$e^+e^- \rightarrow \ell^+\ell^- 2\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

³¹ ABLIKIM 12K measure $\sigma(e^+e^- \rightarrow J/\psi\pi^0) < 1.6$ pb. They assume the $\eta J/\psi$ fully originates from $\psi(4040)$ decays.

NODE=M072R04
NODE=M072R04

NODE=M072R04;LINKAGE=AB

 $\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R05
NODE=M072R05

 $\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R06
NODE=M072R06

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<17	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

<17	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R07
NODE=M072R07

 $\Gamma(\chi_{c1}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R08
NODE=M072R08

 $\Gamma(\chi_{c2}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<32	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R09
NODE=M072R09

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	³² PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

³² From several values of $\sqrt{s}$ near the peak of the $\psi(4040)$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 1.0 \pm 8.0 \pm 5.4 \pm 0.2$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M072R24
NODE=M072R24

NODE=M072R24;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	3.97–4.06 $e^+e^- \rightarrow$ hadrons

NODE=M072R10
NODE=M072R10

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	³³ ABLIKIM 13Q	BES3	$e^+e^- \rightarrow \psi(4040)$

³³ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R26
NODE=M072R26

NODE=M072R26;LINKAGE=A

$\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	³⁴ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁴ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R27
 NODE=M072R27

NODE=M072R27;LINKAGE=A

 $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	³⁵ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁵ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R28
 NODE=M072R28

NODE=M072R28;LINKAGE=A

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	³⁶ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁶ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R29
 NODE=M072R29

NODE=M072R29;LINKAGE=A

 $\Gamma(\Sigma^0\bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	³⁷ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁷ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R30
 NODE=M072R30

NODE=M072R30;LINKAGE=A

 $\Gamma(\Xi^+\bar{\Xi}^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	³⁸ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁸ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R31
 NODE=M072R31

NODE=M072R31;LINKAGE=A

 $\Gamma(\Xi^0\bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	³⁹ ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

³⁹ Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R32
 NODE=M072R32

NODE=M072R32;LINKAGE=A

$\psi(4040)$ REFERENCES

ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AW	PR D104 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
ABLIKIM	13Q	PR D87 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
ABLIKIM	12K	PR D86 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
Also		ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
GOLDHABER	77	PL 69B 503	G. Goldhaber <i>et al.</i>	(Mark I Collab.)

NODE=M072

REFID=62437
 REFID=61454
 REFID=61479
 REFID=60744
 REFID=60344
 REFID=58710
 REFID=56816
 REFID=55393
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 REFID=53143
 REFID=52142
 REFID=52132
 REFID=52134
 REFID=51628
 REFID=51075
 REFID=50813
 REFID=50506
 REFID=50503
 REFID=51064
 REFID=22232
 REFID=22114
 REFID=22062
 REFID=11434

NODE=M193

$\chi_{c1}(4140)$

$I^G(J^{PC}) = 0^+(1^{++})$

was $X(4140)$

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M193

Seen by AALTONEN 09AH, ABAZOV 14A, CHATRCHYAN 14M, AAIJ 17C in $B^+ \rightarrow \chi_{c1} K^+$, $\chi_{c1} \rightarrow J/\psi \phi$, and by ABAZOV 15M separately in both prompt (4.7σ) and non-prompt (5.6σ) production in $p\bar{p} \rightarrow J/\psi \phi + \text{anything}$. Not seen by SHEN 10 in $\gamma\gamma \rightarrow J/\psi \phi$ and ABLIKIM 15 in $e^+e^- \rightarrow \gamma J/\psi \phi$ at $\sqrt{s} = 4.23, 4.26, 4.36 \text{ GeV}$.

$\chi_{c1}(4140)$ MASS

NODE=M193M

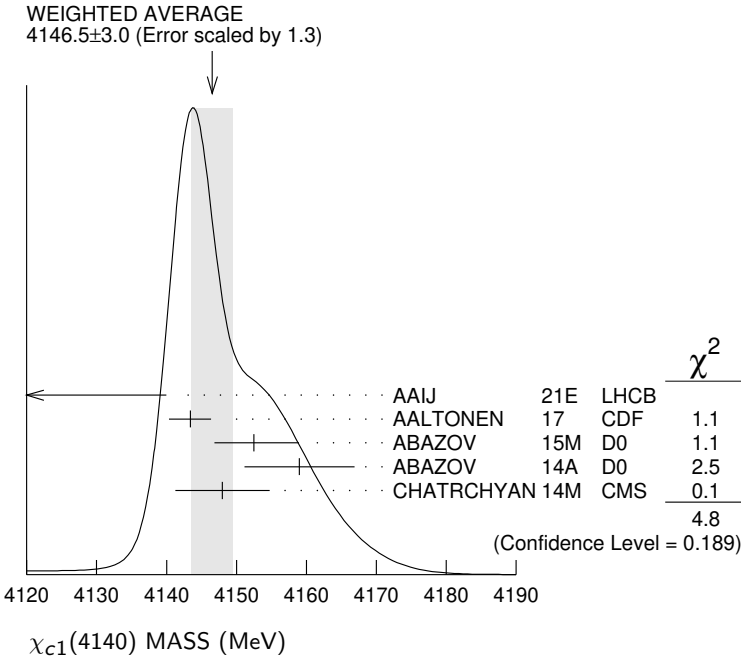
NODE=M193M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4146.5± 3.0 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
4118 ±11 ⁺¹⁹ ₋₃₆	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4143.4 ^{+2.9} _{-3.0} ± 0.6	19	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
4152.5± 1.7 ^{+6.2} _{-5.4}	616	³ ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
4159.0± 4.3± 6.6	52	⁴ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
4148.0± 2.4± 6.3	0.3k	⁵ CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi \phi K^+$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
4146.5± 4.5 ^{+4.6} _{-2.8}	4289	^{6,7} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4143.0± 2.9± 1.2	14	^{8,9} AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M193M;LINKAGE=G
NODE=M193M;LINKAGE=E
NODE=M193M;LINKAGE=C
NODE=M193M;LINKAGE=A
NODE=M193M;LINKAGE=B

NODE=M193M;LINKAGE=D
NODE=M193M;LINKAGE=H
NODE=M193M;LINKAGE=AA
NODE=M193M;LINKAGE=F

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13σ .
- ² Statistical significance of more than 5σ .
- ³ Statistical significance of more than 6σ .
- ⁴ Statistical significance of 3.1σ .
- ⁵ From a fit assuming an S -wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5σ .
- ⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4σ .
- ⁷ Superseded by AAIJ 21E.
- ⁸ Statistical significance of 3.8σ .
- ⁹ Superseded by AALTONEN 17.



$\chi_{c1}(4140)$ WIDTH

NODE=M193W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
19 $\pm \frac{7}{5}$ OUR AVERAGE				
162 ± 21 $^{+24}_{-49}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
15.3 $^{+10.4}_{-6.1} \pm 2.5$	19	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
16.3 $\pm 5.6 \pm 11.4$	616	³ ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
20 ± 13 $^{+3}_{-8}$	52	⁴ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
28 $^{+15}_{-11} \pm 19$	0.3k	⁵ CHATRCHYAN	14M CMS	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
83 ± 21 $^{+21}_{-14}$	4289	^{6,7} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
11.7 $^{+8.3}_{-5.0} \pm 3.7$	14	^{8,9} AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13 σ . ² Statistical significance of more than 5 σ . ³ Statistical significance of more than 6 σ . ⁴ Statistical significance of 3.1 σ . ⁵ From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 σ . ⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4 σ . ⁷ Superseded by AAIJ 21E. ⁸ Statistical significance of 3.8 σ . ⁹ Superseded by AALTONEN 17.				

NODE=M193W

NODE=M193W;LINKAGE=G
 NODE=M193W;LINKAGE=E
 NODE=M193W;LINKAGE=C
 NODE=M193W;LINKAGE=A
 NODE=M193W;LINKAGE=B

NODE=M193W;LINKAGE=D
 NODE=M193W;LINKAGE=H
 NODE=M193W;LINKAGE=AA
 NODE=M193W;LINKAGE=F

 $\chi_{c1}(4140)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen
Γ_2 $\gamma\gamma$	not seen

NODE=M193215;NODE=M193

DESIG=1

DESIG=2

 $\chi_{c1}(4140)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<41	90	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6	90	² SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$
¹ For $J^P = 0^+$. ² For $J^P = 2^+$.				

NODE=M193220

NODE=M193G01
 NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
 NODE=M193G01;LINKAGE=S2

 $\chi_{c1}(4140)$ BRANCHING RATIOS

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
seen	616	² ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
seen	52	³ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
seen	0.3k	⁴ CHATRCHYAN	14M CMS	$B^+ \rightarrow J/\psi \phi K^+$
seen	14	⁵ AALTONEN	09AH CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	4289	^{6,7} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
not seen		⁸ ABLIKIM	15 BES3	$e^+ e^- \rightarrow \gamma \phi J/\psi$
not seen		⁹ AAIJ	12AA LHCb	$p\bar{p} \rightarrow B^+ X$ at 7 TeV

NODE=M193225

NODE=M193R01
 NODE=M193R01

- ¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 13 σ .
² Statistical significance of more than 6 σ .
³ ABAZOV 14A reports $B(B^+ \rightarrow \chi_{c1}(4140) K^+ \rightarrow J/\psi \phi K^+)/B(B^+ \rightarrow J/\psi \phi K^+) = (19 \pm 7 \pm 4)\%$ with 3.1 σ significance.
⁴ From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than 5 σ .
⁵ Statistical significance of 3.8 σ .
⁶ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 8.4 σ .
⁷ Superseded by AAIJ 21E.
⁸ Reported $\sigma(e^+ e^- \rightarrow \gamma \chi_{c1}(4140)) \cdot B(\chi_{c1}(4140) \rightarrow J/\psi \phi) < 0.35, 0.28, \text{ and } 0.33$ pb at 4.23, 4.26, and 4.36 GeV, respectively, at 90% CL.
⁹ Reported $B(B^+ \rightarrow \chi_{c1}(4140) K^+) \cdot B(\chi_{c1}(4140) \rightarrow J/\psi \phi)/B(B^+ \rightarrow J/\psi \phi K^+) < 0.07$ at 90% CL.

NODE=M193R01;LINKAGE=F
 NODE=M193R01;LINKAGE=D
 NODE=M193R01;LINKAGE=A

NODE=M193R01;LINKAGE=C

NODE=M193R01;LINKAGE=AA
 NODE=M193R01;LINKAGE=E
 NODE=M193R01;LINKAGE=G
 NODE=M193R01;LINKAGE=B

NODE=M193R01;LINKAGE=AI

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

NODE=M193R02
 NODE=M193R02

 $\chi_{c1}(4140)$ REFERENCES

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	17	MPL A32 1750139	T. Altonen <i>et al.</i>	(CDF Collab.)
ABAZOV	15M	PRL 115 232001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	15	PR D91 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABAZOV	14A	PR D89 012004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	14M	PL B734 261	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
AAIJ	12AA	PR D85 091103	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AALTONEN	09AH	PRL 102 242002	T. Aaltonen <i>et al.</i>	(CDF Collab.)

NODE=M193

REFID=61150
 REFID=57657
 REFID=57636
 REFID=58161
 REFID=56957
 REFID=56368
 REFID=55650
 REFID=55753
 REFID=54263
 REFID=53235
 REFID=52968

 $\psi(4160)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M025

 $\psi(4160)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4191 ± 5 OUR AVERAGE			
4186.8 ± 8.7 ± 30	¹ ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
4191 $^{+9}_{-8}$	AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$
4191.7 ± 6.5	² ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 ± 7	³ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4151 ± 4	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4155 ± 5	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4159 ± 20	BRANDELIK	78C DASP	e^+e^-

NODE=M025M

NODE=M025M

OCCUR=2

¹ Could also be the $\psi(4230)$.² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.³ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.⁴ From a fit to Crystal Ball (OSTERHELD 86) data.⁵ From a fit to BES (BAI 02C) data.

NODE=M025M;LINKAGE=B
 NODE=M025M;LINKAGE=AB

NODE=M025M;LINKAGE=MO

NODE=M025M;LINKAGE=ST
 NODE=M025M;LINKAGE=SE

 $\psi(4160)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
69 ± 10 OUR AVERAGE			
[70 ± 10 MeV OUR 2023 AVERAGE]			
55 ± 15 ± 53	¹ ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
65 $^{+22}_{-16}$	AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$
71.8 ± 12.3	² ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 ± 14	³ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
107 ± 10	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
107 ± 16	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
78 ± 20	BRANDELIK	78C DASP	e^+e^-

NODE=M025W

NODE=M025W
 NEW

OCCUR=2

¹ Could also be the $\psi(4230)$.² Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.³ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.⁴ From a fit to Crystal Ball (OSTERHELD 86) data.⁵ From a fit to BES (BAI 02C) data.

NODE=M025W;LINKAGE=B
 NODE=M025W;LINKAGE=AB

NODE=M025W;LINKAGE=MO

NODE=M025W;LINKAGE=ST
 NODE=M025W;LINKAGE=SE

$\psi(4160)$ DECAY MODES

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, "seen" ("not seen") means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle's central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

NODE=M025215;NODE=M025

NODE=M025

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 e^+e^-	$(6.9 \pm 3.3) \times 10^{-6}$		DESIG=1
Γ_2 $\mu^+\mu^-$	seen		DESIG=33
Γ_3 $D\bar{D}$	seen		DESIG=15;OUR EVAL;→ UNCHECKED ←
Γ_4 $D^0\bar{D}^0$	seen		DESIG=16
Γ_5 D^+D^-	seen		DESIG=17
Γ_6 $D^*\bar{D} + \text{c.c.}$	seen		DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_7 $D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen		DESIG=19
Γ_8 $D^*(2010)^+D^- + \text{c.c.}$	seen		DESIG=20
Γ_9 $D^*\bar{D}^*$	seen		DESIG=21;OUR EVAL;→ UNCHECKED ←
Γ_{10} $D^*(2007)^0\bar{D}^*(2007)^0$	seen		DESIG=22
Γ_{11} $D^*(2010)^+D^*(2010)^-$	seen		DESIG=23
Γ_{12} $D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^- + \text{c.c.)}$	not seen		DESIG=24
Γ_{13} $D\bar{D}^*\pi + \text{c.c. (excl. } D^*\bar{D}^*)$	seen		DESIG=25
Γ_{14} $D^0D^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-)$	not seen		DESIG=26
Γ_{15} $D_s^+D_s^-$	not seen		DESIG=27
Γ_{16} $D_s^{*+}D_s^- + \text{c.c.}$	seen		DESIG=28
Γ_{17} $J/\psi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%	DESIG=2
Γ_{18} $J/\psi\pi^0\pi^0$	$< 3 \times 10^{-3}$	90%	DESIG=3
Γ_{19} $J/\psi K^+K^-$	$< 2 \times 10^{-3}$	90%	DESIG=4
Γ_{20} $J/\psi\eta$	$< 8 \times 10^{-3}$	90%	DESIG=5
Γ_{21} $J/\psi\pi^0$	$< 1 \times 10^{-3}$	90%	DESIG=6
Γ_{22} $J/\psi\eta'$	$< 5 \times 10^{-3}$	90%	DESIG=7
Γ_{23} $J/\psi\pi^+\pi^-\pi^0$	$< 1 \times 10^{-3}$	90%	DESIG=8
Γ_{24} $\psi(2S)\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%	DESIG=9
Γ_{25} $\chi_{c1}\gamma$	$< 5 \times 10^{-3}$	90%	DESIG=10
Γ_{26} $\chi_{c2}\gamma$	$< 1.3 \%$	90%	DESIG=11
Γ_{27} $\chi_{c1}\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%	DESIG=12
Γ_{28} $\chi_{c2}\pi^+\pi^-\pi^0$	$< 8 \times 10^{-3}$	90%	DESIG=13
Γ_{29} $h_c(1P)\pi^+\pi^-$	$< 5 \times 10^{-3}$	90%	DESIG=29
Γ_{30} $h_c(1P)\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%	DESIG=30
Γ_{31} $h_c(1P)\eta$	$< 2 \times 10^{-3}$	90%	DESIG=31
Γ_{32} $h_c(1P)\pi^0$	$< 4 \times 10^{-4}$	90%	DESIG=32
Γ_{33} $\omega\pi^+\pi^-$	seen		DESIG=49;OUR EVAL;→ UNCHECKED ←
Γ_{34} $\phi\pi^+\pi^-$	$< 2 \times 10^{-3}$	90%	DESIG=14
Γ_{35} $\gamma\chi_{c1}(3872)$	$< 1.9 \times 10^{-3}$	90%	DESIG=44
Γ_{36} $\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.36 \times 10^{-4}$	90%	DESIG=35
Γ_{37} $\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.18 \times 10^{-4}$	90%	DESIG=36
Γ_{38} $\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.47 \times 10^{-4}$	90%	DESIG=37
Γ_{39} $\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi$	$< 1.26 \times 10^{-4}$	90%	DESIG=39
Γ_{40} $\gamma X(3930) \rightarrow \gamma\gamma J/\psi$	$< 8.8 \times 10^{-5}$	90%	DESIG=40
Γ_{41} $\gamma X(3940) \rightarrow \gamma\gamma J/\psi$	$< 1.79 \times 10^{-4}$	90%	DESIG=41
Γ_{42} $\omega\pi^0$	not seen		DESIG=47
Γ_{43} $\omega\eta$	not seen		DESIG=48
Γ_{44} K^+K^-	not seen		DESIG=42;OUR EVAL;→ UNCHECKED ←
Γ_{45} $K_S^0 K^\pm\pi^\mp$	seen		DESIG=43;OUR EVAL;→ UNCHECKED ←
Γ_{46} $p\bar{p}p\bar{p}$	not seen		DESIG=45
Γ_{47} $\Lambda\bar{\Lambda}$	$< 1.5 \times 10^{-6}$	90%	DESIG=46
Γ_{48} $\Xi^-\Xi^+$	$< 8 \times 10^{-5}$	90%	DESIG=50
Γ_{49} $pK^-\bar{\Lambda} + \text{c.c.}$	$< 6 \times 10^{-6}$	90%	DESIG=51

$\psi(4160)$ PARTIAL WIDTHS $\Gamma(e^+e^-)$ Γ_1

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.48±0.22	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.4 to 1.1	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
0.83±0.08	³ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
0.84±0.13	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
0.77±0.23	BRANDELIK	78C DASP	e^+e^-

¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (293 \pm 57)^\circ$.

² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different e^+e^- partial widths. We quote only the range of values.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

NODE=M025220

NODE=M025W1
NODE=M025W1

OCCUR=2

NODE=M025W1;LINKAGE=AB

NODE=M025W1;LINKAGE=MO

NODE=M025W1;LINKAGE=ST

NODE=M025W1;LINKAGE=SE

 $\Gamma(\mu^+\mu^-)$ Γ_2

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.45±1.24±0.94	^{1,2} ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+\mu^-$

¹ From a fit to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+\mu^-) = \Gamma(e^+e^-)$.

² From solution 1 of 8 with equal fit quality. Other solutions range from $2.08 \pm 0.99 \pm 0.80$ to $2.45 \pm 1.24 \pm 0.94$ keV.

NODE=M025W2
NODE=M025W2

NODE=M025W2;LINKAGE=A

NODE=M025W2;LINKAGE=B

 $\psi(4160) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M025235

 $\Gamma(J/\psi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.17±0.04	86	^{1,2} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$
1.07±0.09	86	^{1,3} ABLIKIM	20A BES3	$e^+e^- \rightarrow \eta' J/\psi$

¹ Based on a fit to $\sigma(e^+e^- \rightarrow \eta' J/\psi)$ from $\sqrt{s} = 4.18$ to 4.60 GeV assuming interfering $\psi(4160)$ and $\psi(4260)$ contributions. At $\sqrt{s} = 4.18$ GeV, $\sigma(e^+e^- \rightarrow \eta' J/\psi) = 2.4 \pm 0.3 \pm 0.2$ pb.

² Solution I of the fit, corresponding to a phase of -0.03 ± 0.44 rad.

³ Solution II of the fit, corresponding to a phase of 2.54 ± 0.04 rad.

NODE=M025R42
NODE=M025R42

OCCUR=2

NODE=M025R42;LINKAGE=A

NODE=M025R42;LINKAGE=B

NODE=M025R42;LINKAGE=C

 $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{25}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G01
NODE=M025G01

NODE=M025G01;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{26}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<6.1	90	¹ HAN	15 BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M025G02
NODE=M025G02

NODE=M025G02;LINKAGE=A

 $\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{33}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
0.0011±0.0008±0.0001	^{1,2} ABLIKIM	23AQ BES3	fit to cross sections
0.651 ±0.012 ±0.040	^{2,3} ABLIKIM	23AQ BES3	fit to cross sections

¹ Solution I of the fit.

² From a fit to $e^+e^- \rightarrow \omega\pi^+\pi^-$ cross sections between 4 and 4.6 GeV. Recalculated from 12 $\pi \Gamma(e^+e^-) B(\psi(4230) \rightarrow \omega\pi^+\pi^-)$. First uncertainty is from statistical and uncommon systematic uncertainties, and the second is a 6.2% common systematic uncertainty quoted in the paper.

³ Solution II of the fit.

NODE=M025R48
NODE=M025R48

OCCUR=3

OCCUR=4

NODE=M025R48;LINKAGE=A

NODE=M025R48;LINKAGE=C

NODE=M025R48;LINKAGE=B

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{45} \Gamma_1 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.71 ± 0.13 ± 0.12	¹ ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
0.0095 ± 0.0088 ± 0.0004	² ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

¹ Solution I of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

² Solution II of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

NODE=M025R00
NODE=M025R00

OCCUR=5

NODE=M025R00;LINKAGE=A

NODE=M025R00;LINKAGE=D

$$\Gamma(\Lambda \bar{\Lambda}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{47} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

$< 0.7 \times 10^{-3}$	90	¹ ABLIKIM	21AS BES3	$e^+ e^- \rightarrow \psi(4160)$

¹ From a measurement of the $e^+ e^- \rightarrow \Lambda \bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M025R45
NODE=M025R45

NODE=M025R45;LINKAGE=A

$$\Gamma(\Xi^- \bar{\Xi}^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{48} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

$< 3.72 \times 10^{-2}$	90	¹ ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(4160)$

¹ From a fit to $e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$ cross sections.

NODE=M025R49
NODE=M025R49

NODE=M025R49;LINKAGE=A

$$\Gamma(p K^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{49} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

$< 3.0 \times 10^{-3}$	90	¹ ABLIKIM	23BL BES3	$e^+ e^- \rightarrow \psi(4160)$

¹ From a fit to $e^+ e^- \rightarrow p K^- \bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M025R51
NODE=M025R51

NODE=M025R51;LINKAGE=A

$$\psi(4160) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma^2(\text{total})$$

NODE=M025230

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{20} / \Gamma \times \Gamma_1 / \Gamma$$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.8 \pm 0.9 \pm 0.9$	¹ WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$
$12.8 \pm 1.7 \pm 2.0$	² WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

¹ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

² Solution II of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4153 MeV and 103 MeV, respectively.

NODE=M025R32
NODE=M025R32

OCCUR=2

NODE=M025R32;LINKAGE=A

NODE=M025R32;LINKAGE=B

$$\psi(4160) \text{ BRANCHING RATIOS}$$

NODE=M025225

$$\Gamma(\mu^+ \mu^-) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ AAIJ	13BC LHCB	$B^+ \rightarrow K^+ \mu^+ \mu^-$

¹ AAIJ 13BC report $B(B^+ \rightarrow K^+ \psi(4160)) B(\psi(4160) \rightarrow \mu^+ \mu^-) = (3.5^{+0.9}_{-0.8}) \times 10^{-9}$.

NODE=M025R31
NODE=M025R31

NODE=M025R31;LINKAGE=A

$$\Gamma(D \bar{D}) / \Gamma(D^* \bar{D}^*) \quad \Gamma_3 / \Gamma_9$$

VALUE	DOCUMENT ID	TECN	COMMENT

$0.02 \pm 0.03 \pm 0.02$	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M025R14
NODE=M025R14

$$\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^0 \bar{D}^0$

seen	PAKHLOVA 08	BELL	$e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^0 \bar{D}^0 \gamma$

NODE=M025R16
NODE=M025R16

$$\Gamma(D^+ D^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^+ D^-$

seen	PAKHLOVA 08	BELL	$e^+ e^- \rightarrow D^+ D^- \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^+ D^- \gamma$

NODE=M025R17
NODE=M025R17

$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_7/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$

NODE=M025R18
NODE=M025R18

 $\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ZHUKOVA 18	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$

NODE=M025R19
NODE=M025R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

¹ Supersedes PAKHLOVA 07.

NODE=M025R19;LINKAGE=A

 $\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(D^* \bar{D}^*)$
 Γ_6/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
0.34 ± 0.14 ± 0.05	AUBERT 09M	BABR	$e^+ e^- \rightarrow \gamma D^{(*)} \bar{D}^{(*)}$

NODE=M025R15
NODE=M025R15

 $\Gamma(D^*(2007)^0 \bar{D}^{*0} (2007)^0)/\Gamma_{\text{total}}$
 Γ_{10}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$

NODE=M025R20
NODE=M025R20

 $\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$
 Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ZHUKOVA 18	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	AUBERT 09M	BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$

NODE=M025R21
NODE=M025R21

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

¹ Supersedes PAKHLOVA 07.

NODE=M025R21;LINKAGE=A

 $\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$
 Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M025R22
NODE=M025R22

 $\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$
 Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$

NODE=M025R23
NODE=M025R23

 $\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$
 Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M025R24
NODE=M025R24

 $\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$
 Γ_{15}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^+ D_s^- \gamma$
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^-$

NODE=M025R25
NODE=M025R25

 $\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{16}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 11	BELL	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	DEL-AMO-SA..10N	BABR	$e^+ e^- \rightarrow D_s^{*+} D_s^- \gamma$
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D_s^{*+} D_s^-$

NODE=M025R26
NODE=M025R26

 $\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$
 Γ_{17}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	4.12–4.2 e ⁺ e ⁻ → hadrons

NODE=M025R01
NODE=M025R01

 $\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$
 Γ_{18}/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<3	90	COAN 06	CLEO	4.12–4.2 e ⁺ e ⁻ → hadrons

NODE=M025R02
NODE=M025R02

$\Gamma(J/\psi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R03
 NODE=M025R03

 $\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R04
 NODE=M025R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	¹ ABLIKIM	15L	BES3	$e^+ e^- \rightarrow J/\psi \eta$
seen	WANG	13B	BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

¹ An enhancement around 4.2 GeV is observed.

NODE=M025R04;LINKAGE=A

 $\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R05
 NODE=M025R05

 $\Gamma(J/\psi \eta')/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R06
 NODE=M025R06

 $\Gamma(J/\psi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R07
 NODE=M025R07

 $\Gamma(\psi(2S) \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R08
 NODE=M025R08

 $\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

NODE=M025R09
 NODE=M025R09

 $\Gamma(\chi_{c2} \gamma)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R10
 NODE=M025R10

 $\Gamma(\chi_{c1} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R11
 NODE=M025R11

 $\Gamma(\chi_{c2} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<8	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons

NODE=M025R12
 NODE=M025R12

 $\Gamma(h_c(1P) \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ PEDLAR	11	CLEO $e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$

NODE=M025R27
 NODE=M025R27

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-) = 15.6 \pm 2.3 \pm 1.9 \pm 3.0$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R27;LINKAGE=PE

 $\Gamma(h_c(1P) \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	¹ PEDLAR	11	CLEO $e^+ e^- \rightarrow h_c(1P) \pi^0 \pi^0$

NODE=M025R28
 NODE=M025R28

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+ e^- \rightarrow h_c(1P) \pi^0 \pi^0) = 3.0 \pm 3.3 \pm 1.1 \pm 0.6$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R28;LINKAGE=PE

$\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	¹ PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen 41 ² ABLIKIM 17R BES3 $e^+e^- \rightarrow h_c(1P)\eta$

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\eta) = 4.7 \pm 1.7 \pm 1.0 \pm 0.9$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

² An enhancement around 4.2 GeV is observed.

NODE=M025R29
NODE=M025R29

NODE=M025R29;LINKAGE=PE

NODE=M025R29;LINKAGE=A

 $\Gamma(h_c(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.4	90	¹ PEDLAR 11	CLEO	$e^+e^- \rightarrow h_c(1P)\pi^0$

¹ At $\sqrt{s} = 4170$ MeV, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^0) = -0.7 \pm 1.8 \pm 0.7 \pm 0.1$ pb, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M025R30
NODE=M025R30

NODE=M025R30;LINKAGE=PE

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2	90	COAN 06	CLEO	$4.12\text{--}4.2 e^+e^- \rightarrow \text{hadrons}$

NODE=M025R13
NODE=M025R13

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.9 $\times 10^{-3}$ (CL = 90%)		[<1.8 $\times 10^{-3}$ (CL = 90%) OUR 2023 BEST LIMIT]	

<1.9 $\times 10^{-3}$ 90 ^{1,2} XIAO 13 $\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.013 90 ^{1,3} XIAO 13 $\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

² XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S))] < 0.68 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) = 3.5 \times 10^{-2}$.

³ XIAO 13 reports $[\Gamma(\psi(4160) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \gamma J/\psi)] < 1.05 \times 10^{-4}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \gamma J/\psi) = 7.8 \times 10^{-3}$.

NODE=M025R43
NODE=M025R43

OCCUR=2

NODE=M025R43;LINKAGE=A

NODE=M025R43;LINKAGE=B

NODE=M025R43;LINKAGE=C

 $\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.36 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R35
NODE=M025R35

NODE=M025R35;LINKAGE=A

 $\Gamma(\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.18 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R36
NODE=M025R36

NODE=M025R36;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.47 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma J/\psi \pi^+ \pi^-$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R37
NODE=M025R37

NODE=M025R37;LINKAGE=A

 $\Gamma(\gamma\chi_{c0}(3915) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.26 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R39
NODE=M025R39

NODE=M025R39;LINKAGE=A

 $\Gamma(\gamma X(3930) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<0.88 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R40
NODE=M025R40

NODE=M025R40;LINKAGE=A

 $\Gamma(\gamma X(3940) \rightarrow \gamma\gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT
<1.79 $\times 10^{-4}$	90	¹ XIAO 13	$\psi(4160) \rightarrow \gamma\gamma J/\psi$

¹ Obtained by analyzing CLEO data but not authored by the CLEO Collaboration.

NODE=M025R41
NODE=M025R41

NODE=M025R41;LINKAGE=A

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\pi^0$

 Γ_{42}/Γ

NODE=M025R46
 NODE=M025R46

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\eta$

 Γ_{43}/Γ

NODE=M025R47
 NODE=M025R47

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

 Γ_{44}/Γ

NODE=M025R33
 NODE=M025R33

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<2 \times 10^{-5}$ 90 ¹ DRUZHININ 15 RVUE $e^+e^- \rightarrow \psi(3770)$

¹ DRUZHININ 15 uses BABAR and CLEO data taking into account interference of the processes $e^+e^- \rightarrow K^+K^-$ and $e^+e^- \rightarrow K_S^0 K_L^0$.

NODE=M025R33;LINKAGE=A

 $\Gamma(p\bar{p}p\bar{p})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	21D BES3	4.0–4.6 $e^+e^- \rightarrow p\bar{p}p\bar{p}$

 Γ_{46}/Γ

NODE=M025R44
 NODE=M025R44

$\psi(4160)$ REFERENCES

NODE=M025

ABLIKIM	23AQ	JHEP 2308 159	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62313
ABLIKIM	23BH	PRL 131 151903	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62433
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	21D	PR D103 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61031
ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60210
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60744
ABLIKIM	19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59856
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)	REFID=58710
ABLIKIM	17R	PR D96 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58009
GAO	17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan		REFID=57991
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15L	PR D91 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56777
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)	REFID=56962
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
AAJ	13BC	PRL 111 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55229
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
XIAO	13	PR D87 057501	T. Xiao <i>et al.</i>	(NWES, WAYN)	REFID=55381
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53638
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)	REFID=16787
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53532
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)	REFID=53540
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52724
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=53114
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52142
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52132
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=52134
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
COAN	06	PRL 96 162003	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=51075
SETH	05A	PR D72 017501	K.K. Seth		REFID=50813
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50506
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50503
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)	REFID=51064
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22232

X(4160)

$$J^G(J^{PC}) = ?^?(??)$$

NODE=M190

OMITTED FROM SUMMARY TABLE

Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X$, $X \rightarrow D^*\bar{D}^*$

NODE=M190

A state with consistent mass and width is seen by AAIJ 21E in $B^+ \rightarrow X(4160)K^+$ with $X(4160) \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 4.8σ . The $J^{PC} = 2^{-+}$ assignment is favored over other assignments with a significance of more than 4σ .

X(4160) MASS

NODE=M190M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M190M

4153⁺²³₋₂₁ OUR AVERAGE

4146 ± 18 ± 33	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi\phi K^+$
4156 ⁺²⁵ ₋₂₀ ± 15	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8σ .

NODE=M190M;LINKAGE=A

X(4160) WIDTH

NODE=M190W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M190W

136⁺⁶⁰₋₃₅ OUR AVERAGE

135 ± 28 ⁺⁵⁹ ₋₃₀	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi\phi K^+$
139 ± 111 ⁺¹¹¹ ₋₆₁ ± 21	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8σ .

NODE=M190W;LINKAGE=A

X(4160) DECAY MODES

NODE=M190215;NODE=M190

Mode	Fraction (Γ_i/Γ)
Γ_1 $D\bar{D}$	not seen
Γ_2 $D^*\bar{D} + \text{c.c.}$	not seen
Γ_3 $D^*\bar{D}^*$	seen
Γ_4 $J/\psi\phi$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4

X(4160) BRANCHING RATIOS

NODE=M190225

 $\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$ Γ_1/Γ_3 NODE=M190R01
NODE=M190R01

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.09	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

 $\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$ Γ_2/Γ_3 NODE=M190R02
NODE=M190R02

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

 $\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$ Γ_4/Γ NODE=M190R00
NODE=M190R00

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	24k	¹ AAIJ	21E	LHCB $B^+ \rightarrow J/\psi\phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 4.8σ .

NODE=M190R00;LINKAGE=A

X(4160) REFERENCES

NODE=M190

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
PAKHLOV	08	PRL 100 202001	P. Pakhlov <i>et al.</i>	(BELLE Collab.)

REFID=61150
REFID=52302

NODE=M074

 $\psi(4230)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4230)$; was $\psi(4260)$

The original $\psi(4260)$ (also known as $Y(4260)$) was observed by AUBERT,B 05I as a peak in the energy dependence of the $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ cross section and was confirmed by HE 06B, YUAN 07, LEES 12AC, and LIU 13B in the same process. A higher-statistics analysis by ABLIKIM 17B revealed an asymmetry in the cross section and resulted in a shift of the peak position to a lower mass. The $\psi(4260)$ was therefore renamed $\psi(4230)$. The energy-dependent cross sections for e^+e^- to other channels also exhibit peaks in the same mass region. The parameters corresponding to those peaks are also listed here, but the number of states in this region remains to be determined.

NODE=M074

For details see the review on "Spectroscopy of mesons containing two heavy quarks."

$\psi(4230)$ MASS

NODE=M074M

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
4222.1 ± 2.3 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.
 [4222.5 ± 2.4 MeV OUR 2023 AVERAGE Scale factor = 1.7]

NODE=M074M

NEW

4226.9 ± 6.6 ± 22.0	1	ABLIKIM	23U	BES3	$e^+e^- \rightarrow K_S^0 K_S^0 J/\psi$
4209.6 ± 4.7 ± 5.9	2	ABLIKIM	23X	BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$
4221.4 ± 1.5 ± 2.0	3	ABLIKIM	22AMB	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4225.3 ± 2.3 ± 21.5	4	ABLIKIM	22AU	BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$
4234.4 ± 3.2 ± 0.2	5	ABLIKIM	21AJ	BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4216.7 ± 8.9 ± 4.1	6	ABLIKIM	20AG	BES3	$e^+e^- \rightarrow \mu^+ \mu^-$
4220.4 ± 2.4 ± 2.3	7	ABLIKIM	20N	BES3	$e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
4218.6 ± 3.8 ± 2.5	7	ABLIKIM	20O	BES3	$e^+e^- \rightarrow \eta J/\psi$
4218.5 ± 1.6 ± 4.0	8	ABLIKIM	19AI	BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4228.6 ± 4.1 ± 6.3		ABLIKIM	19R	BES3	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$
4200.6 $^{+7.9}_{-13.3}$ ± 3.0	9	ABLIKIM	19V	BES3	$e^+e^- \rightarrow \gamma \chi_{c1}(3872)$
4218 $^{+5.5}_{-4.5}$ ± 0.9		ABLIKIM	17G	BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4231.9 ± 5.3 ± 4.9		ABLIKIM	20N	BES3	$e^+e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0,$ $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$
4222.0 ± 3.1 ± 1.4	10	ABLIKIM	17B	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4209.5 ± 7.4 ± 1.4	11	ABLIKIM	17V	BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4209.1 ± 6.8 ± 7.0	12	ZHANG	17B	RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4223.3 ± 1.6 ± 2.5	13	ZHANG	17C	RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi \text{ or } \psi(2S)$
4230 ± 8 ± 6 180	14	ABLIKIM	15C	BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
4258.6 ± 8.3 ± 12.1	15	LIU	13B	BELL	$e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4245 ± 5 ± 4	16	LEES	12AC	BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4247 ± 12 $^{+17}_{-32}$	15,17	YUAN	07	BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4284 $^{+17}_{-16}$ ± 413.6		HE	06B	CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
4259 ± 8 $^{+2}_{-6}$ 125	18	AUBERT,B	05I	BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

OCCUR=2

OCCUR=2

¹ From a three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.

NODE=M074M;LINKAGE=I

² From a cross-section measurement of $e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4675.3 ± 29.7 (218.3 ± 73.5) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.

NODE=M074M;LINKAGE=J

³ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.

NODE=M074M;LINKAGE=F

⁴ From a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV and a total width of $111.1 \pm 30.1 \pm 15.2$ MeV.

NODE=M074M;LINKAGE=H

⁵ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

NODE=M074M;LINKAGE=C

- 6 Solution 1 of 8 with equal fit quality to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from $4212.8 \pm 7.2 \pm 4.0$ to $4219.4 \pm 11.2 \pm 4.1$ MeV.
- 7 From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.
- 8 From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.
- 9 Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$.
- 10 From a three-resonance fit. Superseded by ABLIKIM 22AM.
- 11 From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.
- 12 From a three-resonance fit.
- 13 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- 14 From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.
- 15 From a two-resonance fit.
- 16 From a single-resonance fit. Supersedes AUBERT, B 051.
- 17 Superseded by LIU 13B.
- 18 From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074M;LINKAGE=HP

NODE=M074M;LINKAGE=GP

NODE=M074M;LINKAGE=CP

NODE=M074M;LINKAGE=FP

NODE=M074M;LINKAGE=G

NODE=M074M;LINKAGE=BP

NODE=M074M;LINKAGE=A

NODE=M074M;LINKAGE=CA

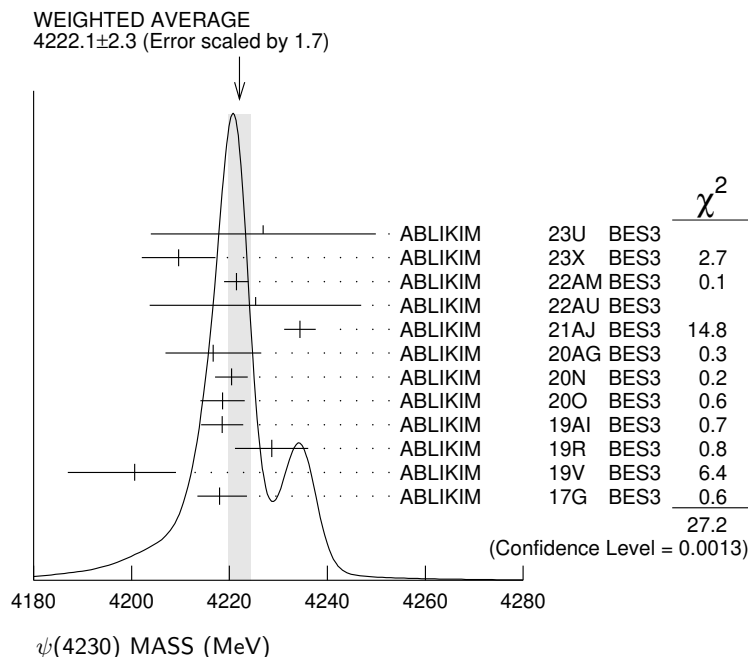
NODE=M074M;LINKAGE=AP

NODE=M074M;LINKAGE=YU

NODE=M074M;LINKAGE=LE

NODE=M074M;LINKAGE=YN

NODE=M074M;LINKAGE=AU

 **$\psi(4230)$ WIDTH**

NODE=M074W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 7 OUR AVERAGE Error includes scale factor of 3.4. See the ideogram below.				
[48 ± 8 MeV OUR 2023 AVERAGE Scale factor = 3.6]				
71.7±16.2±32.8	1	ABLIKIM	23U BES3	$e^+e^- \rightarrow K_S^0 K_S^0 J/\psi$
81.6±17.8± 9.0	2	ABLIKIM	23X BES3	$e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$
41.8± 2.9± 2.7	3	ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+ \pi^- J/\psi$
72.9± 6.1±30.8	4	ABLIKIM	22AU BES3	$e^+e^- \rightarrow K^+ K^- J/\psi$
17.6±18.1± 0.9	5	ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$
47.2±22.8±10.5	6	ABLIKIM	20AG BES3	$e^+e^- \rightarrow \mu^+ \mu^-$
46.2± 4.7± 2.1	7	ABLIKIM	20N BES3	$e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
82.0± 5.7± 0.4	7	ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
28.2± 3.9± 1.6	8	ABLIKIM	19AI BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
77.0± 6.8± 6.3		ABLIKIM	19R BES3	$e^+e^- \rightarrow \pi^+ D^{*0} D^{*-} + \text{c.c.}$
115 $^{+38}_{-26}$ ±12	9	ABLIKIM	19V BES3	$e^+e^- \rightarrow \gamma \chi_{c1}(3872)$
66.0± $^{12.3}_{-8.3}$ ± 0.4		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M074W

NEW

• • • We do not use the following data for averages, fits, limits, etc. • • •

41.2±16.0±16.4	ABLIKIM	20N	BES3	$e^+e^- \rightarrow \pi^0 T_{c\bar{c}1}(3900)^0,$ $T_{c\bar{c}1}^0 \rightarrow \pi^0 J/\psi$
44.1± 4.3± 2.0	¹⁰ ABLIKIM	17B	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
80.1±24.6± 2.9	¹¹ ABLIKIM	17V	BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
76.6±14.2± 2.4	¹² ZHANG	17B	RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
54.2± 2.6± 1.0	¹³ ZHANG	17C	RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi \text{ or } \psi(2S)$
38 ±12 ± 2 180	¹⁴ ABLIKIM	15C	BES3	$e^+e^- \rightarrow \omega \chi_{c0}$
134.1±16.4± 5.5	¹⁵ LIU	13B	BELL	$e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$
114 $\begin{smallmatrix} +16 \\ -15 \end{smallmatrix}$ ± 7	¹⁶ LEES	12AC	BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$
108 ±19 ±10	^{15,17} YUAN	07	BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$
73 $\begin{smallmatrix} +39 \\ -25 \end{smallmatrix}$ ± 5 13.6	HE	06B	CLEO	9.4–10.6 $e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$
88 ±23 $\begin{smallmatrix} +6 \\ -4 \end{smallmatrix}$ 125	¹⁸ AUBERT,B	05I	BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- J/\psi$

OCCUR=2

¹ From a three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.

NODE=M074W;LINKAGE=H

² From a cross-section measurement of $e^+e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4675.3 ± 29.7 (218.3 ± 73.5) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.

NODE=M074W;LINKAGE=I

³ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.

NODE=M074W;LINKAGE=F

⁴ From a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV and a total width of $111.1 \pm 30.1 \pm 15.2$ MeV.

NODE=M074W;LINKAGE=G

⁵ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

NODE=M074W;LINKAGE=D

⁶ Solution 1 of 8 with equal fit quality to the $e^+e^- \rightarrow \mu^+\mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes. Other solutions range from $36.4 \pm 16.8 \pm 8.1$ to $49.6 \pm 22.6 \pm 11.0$ MeV.

NODE=M074W;LINKAGE=GP

⁷ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

NODE=M074W;LINKAGE=FP

⁸ From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.

NODE=M074W;LINKAGE=CP

⁹ Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$.

NODE=M074W;LINKAGE=EP

¹⁰ From a three-resonance fit. Superseded by ABLIKIM 22AM.

NODE=M074W;LINKAGE=E

¹¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^- \psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.

NODE=M074W;LINKAGE=BP

¹² From a three-resonance fit.

NODE=M074W;LINKAGE=C

¹³ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$ data.

NODE=M074W;LINKAGE=B

¹⁴ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M074W;LINKAGE=AP

¹⁵ From a two-resonance fit.

NODE=M074W;LINKAGE=YU

¹⁶ From a single-resonance fit. Supersedes AUBERT,B 05I.

NODE=M074W;LINKAGE=LE

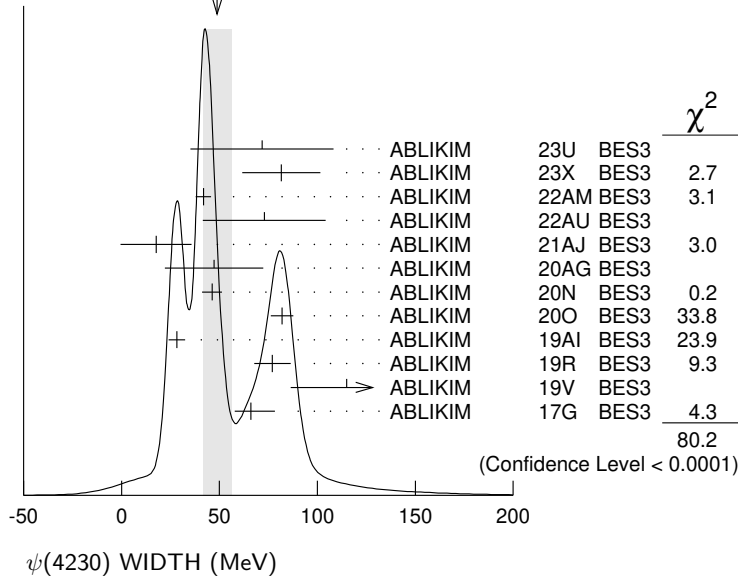
¹⁷ Superseded by LIU 13B.

NODE=M074W;LINKAGE=YN

¹⁸ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W;LINKAGE=AU

WEIGHTED AVERAGE
49±7 (Error scaled by 3.4)



ψ(4230) DECAY MODES

NODE=M074215;NODE=M074

Mode	Fraction (Γ_i/Γ)	
Γ_1 $e^+ e^-$		DESIG=1
Γ_2 $\mu^+ \mu^-$	$(3.1 \pm 2.8) \times 10^{-5}$	DESIG=63
Γ_3 $\eta_c(1S) \pi^+ \pi^-$	not seen	DESIG=65
Γ_4 $\eta_c(1S) \pi^+ \pi^- \pi^0$	seen	DESIG=64
Γ_5 $J/\psi \pi^+ \pi^-$	seen	DESIG=2
Γ_6 $J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-$	seen	DESIG=41;OUR EVAL;→ UNCHECKED ←
Γ_7 $T_{c\bar{c}1}(3900)^\pm \pi^\mp, T_{c\bar{c}1}^\pm \rightarrow J/\psi \pi^\pm$	seen	DESIG=43;OUR EVAL;→ UNCHECKED ←
Γ_8 $J/\psi \pi^0 \pi^0$	seen	DESIG=4
Γ_9 $J/\psi K^+ K^-$	seen	DESIG=5;OUR EVAL;→ UNCHECKED ←
Γ_{10} $J/\psi K_S^0 K_S^0$	not seen	DESIG=44
Γ_{11} $J/\psi \eta$	seen	DESIG=6
Γ_{12} $J/\psi \pi^0$	not seen	DESIG=7;OUR EVAL;→ UNCHECKED ←
Γ_{13} $J/\psi \eta'$	seen	DESIG=8;OUR EVAL;→ UNCHECKED ←
Γ_{14} $J/\psi \pi^+ \pi^- \pi^0$	not seen	DESIG=9;OUR EVAL;→ UNCHECKED ←
Γ_{15} $J/\psi \eta \pi^0$	not seen	DESIG=45
Γ_{16} $J/\psi \eta \eta$	not seen	DESIG=10;OUR EVAL;→ UNCHECKED ←
Γ_{17} $\psi(2S) \pi^+ \pi^-$	seen	DESIG=11
Γ_{18} $\psi(2S) \eta$	not seen	DESIG=12;OUR EVAL;→ UNCHECKED ←
Γ_{19} $\chi_{c0} \omega$	seen	DESIG=13
Γ_{20} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen	DESIG=16;OUR EVAL;→ UNCHECKED ←
Γ_{21} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen	DESIG=17;OUR EVAL;→ UNCHECKED ←
Γ_{22} $h_c(1P) \pi^+ \pi^-$	seen	DESIG=40
Γ_{23} $\phi \pi^+ \pi^-$	not seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_{24} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen	DESIG=22;OUR EVAL;→ UNCHECKED ←
Γ_{25} $\phi K^+ K^-$	not seen	DESIG=72;OUR EVAL;→ UNCHECKED ←
Γ_{26} $\phi K_S^0 K_S^0$	not seen	DESIG=73;OUR EVAL;→ UNCHECKED ←
Γ_{27} $\phi \eta$	not seen	DESIG=76
Γ_{28} $\phi \eta'$	not seen	DESIG=70;OUR EVAL;→ UNCHECKED ←
Γ_{29} $D \bar{D}$	not seen	DESIG=19;OUR EVAL;→ UNCHECKED ←
Γ_{30} $D^0 \bar{D}^0$	not seen	DESIG=31
Γ_{31} $D^+ D^-$	not seen	DESIG=32
Γ_{32} $D^* \bar{D} + c.c.$	not seen	DESIG=23;OUR EVAL;→ UNCHECKED ←
Γ_{33} $D^*(2007)^0 \bar{D}^0 + c.c.$	not seen	DESIG=33
Γ_{34} $D^*(2010)^+ D^- + c.c.$	not seen	DESIG=34

Γ ₃₅	$D^* \bar{D}^*$	not seen	DESIG=24;OUR EST;→ UNCHECKED ←
Γ ₃₆	$D^*(2007)^0 \bar{D}^*(2007)^0$	not seen	DESIG=35
Γ ₃₇	$D^*(2010)^+ D^*(2010)^-$	not seen	DESIG=36
Γ ₃₈	$D \bar{D} \pi + \text{c.c.}$	not seen	DESIG=37;OUR EST;→ UNCHECKED ←
Γ ₃₉	$D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.)}$	not seen	DESIG=38
Γ ₄₀	$D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)$	not seen	DESIG=25
Γ ₄₁	$D^0 D^*(2010)^- \pi^+ + \text{c.c.}$	seen	DESIG=30
Γ ₄₂	$D_1(2420) \bar{D} + \text{c.c.}$	not seen	DESIG=50
Γ ₄₃	$D^* \bar{D}^* \pi$	seen	DESIG=26
Γ ₄₄	$D^{*0} D^{*-} \pi^+$	seen	DESIG=74;OUR EVAL;→ UNCHECKED ←
Γ ₄₅	$D_s^+ D_s^-$	not seen	DESIG=27
Γ ₄₆	$D_s^{*+} D_s^- + \text{c.c.}$	not seen	DESIG=28
Γ ₄₇	$D_s^{*+} D_s^{*-}$	not seen	DESIG=29
Γ ₄₈	$p \bar{p}$	not seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ ₄₉	$p \bar{p} \pi^0$	not seen	DESIG=46;OUR EVAL;→ UNCHECKED ←
Γ ₅₀	$p \bar{p} \eta$	not seen	DESIG=61
Γ ₅₁	$\omega \pi^+ \pi^-$	seen	DESIG=71;OUR EVAL;→ UNCHECKED ←
Γ ₅₂	$p \bar{p} \omega$	not seen	DESIG=62
Γ ₅₃	$\Xi^- \Xi^+$	not seen	DESIG=51;OUR EVAL;→ UNCHECKED ←
Γ ₅₄	$\pi^+ \pi^+ \pi^- \pi^-$	not seen	DESIG=53;OUR EVAL;→ UNCHECKED ←
Γ ₅₅	$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	not seen	DESIG=54;OUR EVAL;→ UNCHECKED ←
Γ ₅₆	$\omega \pi^0$	not seen	DESIG=68
Γ ₅₇	$\omega \eta$	not seen	DESIG=69
Γ ₅₈	$K_S^0 K^\pm \pi^\mp$	not seen	DESIG=20;OUR EVAL;→ UNCHECKED ←
Γ ₅₉	$K_S^0 K^\pm \pi^\mp \pi^0$	not seen	DESIG=48;OUR EVAL;→ UNCHECKED ←
Γ ₆₀	$K_S^0 K^\pm \pi^\mp \eta$	not seen	DESIG=49;OUR EVAL;→ UNCHECKED ←
Γ ₆₁	$K^+ K^- \pi^0$	not seen	DESIG=21;OUR EVAL;→ UNCHECKED ←
Γ ₆₂	$K^+ K^- \pi^+ \pi^-$	not seen	DESIG=55;OUR EVAL;→ UNCHECKED ←
Γ ₆₃	$K^+ K^- \pi^+ \pi^- \pi^0$	not seen	DESIG=56;OUR EVAL;→ UNCHECKED ←
Γ ₆₄	$K^+ K^+ K^- K^-$	not seen	DESIG=57;OUR EVAL;→ UNCHECKED ←
Γ ₆₅	$K^+ K^+ K^- K^- \pi^0$	not seen	DESIG=58;OUR EVAL;→ UNCHECKED ←
Γ ₆₆	$p \bar{p} \pi^+ \pi^-$	not seen	DESIG=59;OUR EVAL;→ UNCHECKED ←
Γ ₆₇	$p \bar{p} \pi^+ \pi^- \pi^0$	not seen	DESIG=60;OUR EVAL;→ UNCHECKED ←
Γ ₆₈	$p \bar{p} p \bar{p}$	not seen	DESIG=67
Γ ₆₉	$\Lambda \bar{\Lambda}$	not seen	DESIG=52;OUR EVAL;→ UNCHECKED ←
Γ ₇₀	$p K^- \bar{\Lambda} + \text{c.c.}$	not seen	DESIG=75

Radiative decays

Γ ₇₁	$\eta_c(1S) \gamma$	possibly seen	NODE=M074;CLUMP=C
Γ ₇₂	$\eta_c(1S) \pi^0 \gamma$	not seen	DESIG=47
Γ ₇₃	$\chi_{c1} \gamma$	not seen	DESIG=66
Γ ₇₄	$\chi_{c2} \gamma$	not seen	DESIG=14;OUR EVAL;→ UNCHECKED ←
Γ ₇₅	$\chi_{c1}(3872) \gamma$	seen	DESIG=15;OUR EVAL;→ UNCHECKED ←
			DESIG=42

$\psi(4230)$ PARTIAL WIDTHS

$\Gamma(\mu^+ \mu^-)$				Γ ₂
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
1.53±1.26±0.54	^{1,2} ABLIKIM	20AG BES3	$e^+ e^- \rightarrow \mu^+ \mu^-$	
¹ From a fit to the $e^+ e^- \rightarrow \mu^+ \mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$. ² From solution 1 of 8 with equal fit quality. Other solutions range from $1.09 \pm 0.84 \pm 0.39$ to $1.53 \pm 1.26 \pm 0.54$ keV.				

NODE=M074235

NODE=M074W01
NODE=M074W01

NODE=M074W01;LINKAGE=A

NODE=M074W01;LINKAGE=B

$\psi(4230) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M074230

 $\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_5 \Gamma_1 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

9.2±1.0 OUR AVERAGE

9.2±0.8±0.7		¹ LEES	12AC BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
8.9 ^{+3.9} _{-3.1} ±1.8	8.1	HE	06B CLEO	9.4–10.6 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.4±0.8±0.6		² LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.5±1.4±2.0		³ LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
6.0±1.2 ^{+4.7} _{-0.5}		^{2,4} YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
20.6±2.3 ^{+9.1} _{-1.7}		^{3,4} YUAN	07 BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$
5.5±1.0 ^{+0.8} _{-0.7}	125	⁵ AUBERT,B	05I BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

OCCUR=2

OCCUR=2

¹ From a single-resonance fit. Supersedes AUBERT,B 05I.² Solution I of two equivalent solutions in a fit using two interfering resonances.³ Solution II of two equivalent solutions in a fit using two interfering resonances.⁴ Superseded by LIU 13B.⁵ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074G1;LINKAGE=LE
 NODE=M074G1;LINKAGE=YU
 NODE=M074G1;LINKAGE=YA
 NODE=M074G1;LINKAGE=YN
 NODE=M074G1;LINKAGE=AU

 $\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.42±0.04±0.15		¹ ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
0.29±0.02±0.10		² ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
<1.7	90	³ SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$
<1.2	90	⁴ YUAN	08 BELL	$e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

NODE=M074G3
 NODE=M074G3

OCCUR=2

¹ Solution I from a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV, a total width of $111.1 \pm 30.1 \pm 15.2$ MeV, and $\Gamma_{ee} \cdot B = 1.35 \pm 0.14 \pm 0.07$ eV. The phase difference is $1.72 \pm 0.09 \pm 0.52$ rad.² Solution II from a two-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.127\text{--}4.600$ GeV. The second resonance has a mass of $4484.7 \pm 13.3 \pm 24.1$ MeV, a total width of $111.1 \pm 30.1 \pm 15.2$ MeV, and $\Gamma_{ee} \cdot B = 0.41 \pm 0.08 \pm 0.13$ eV. The phase difference is $5.49 \pm 0.35 \pm 0.58$ rad.³ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $\psi(4260)$ amplitude with mass and width from LIU 13B. Supersedes YUAN 08. The shape of the cross section observed by ABLIKIM 18N between 4.2 and 4.3 GeV is incompatible with that of $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ in ABLIKIM 13T and ABLIKIM 17B. They also observe a broad enhancement around 4.5 GeV.⁴ From a fit of the broad $K^+ K^- J/\psi$ enhancement including a coherent $\psi(4260)$ amplitude with mass and width from YUAN 07.

NODE=M074G3;LINKAGE=B

NODE=M074G3;LINKAGE=C

NODE=M074G3;LINKAGE=A

NODE=M074G3;LINKAGE=YU

 $\Gamma(J/\psi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{10} \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.85	90	¹ SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13±0.02±0.05		^{2,3} ABLIKIM	23U BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
0.14±0.03±0.06		^{2,4} ABLIKIM	23U BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
0.18±0.05±0.07		^{2,5} ABLIKIM	23U BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$
0.20±0.04±0.07		^{2,6} ABLIKIM	23U BES3	$e^+ e^- \rightarrow K_S K_S J/\psi$

NODE=M074G02
 NODE=M074G02

OCCUR=2

OCCUR=3

OCCUR=4

¹ From a fit of the $K_S^0 K_S^0 J/\psi$ mass range from 4.4 to 5.5 GeV including a coherent $\psi(4260)$ amplitude with mass and width from LIU 13B.² A three-resonance fit to the dressed cross section in the range $\sqrt{s} = 4.128\text{--}4.950$ GeV.³ Solution I.⁴ Solution II.⁵ Solution III.⁶ Solution IV.

NODE=M074G02;LINKAGE=A

NODE=M074G02;LINKAGE=B
 NODE=M074G02;LINKAGE=F
 NODE=M074G02;LINKAGE=C
 NODE=M074G02;LINKAGE=D
 NODE=M074G02;LINKAGE=E

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

8.0 ± 1.7		¹ ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$
4.8 ± 1.0		² ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$
7.0 ± 1.5		³ ABLIKIM	200	BES3	$e^+e^- \rightarrow \eta J/\psi$
<14.2	90	WANG	13B	BELL	$e^+e^- \rightarrow J/\psi \eta \gamma$

¹ Solution 1 of three equivalent fit solutions using three resonant structures.

² Solution 2 of three equivalent fit solutions using three resonant structures.

³ Solution 3 of three equivalent fit solutions using three resonant structures.

NODE=M074G01
NODE=M074G01

OCCUR=2

OCCUR=3

NODE=M074G01;LINKAGE=A

NODE=M074G01;LINKAGE=B

NODE=M074G01;LINKAGE=C

 $\Gamma(J/\psi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.06 ± 0.03	46	^{1,2} ABLIKIM	20A	BES3	$e^+e^- \rightarrow \eta' J/\psi$
1.38 ± 0.11	46	^{1,3} ABLIKIM	20A	BES3	$e^+e^- \rightarrow \eta' J/\psi$

¹ Based on a fit to $\sigma(e^+e^- \rightarrow \eta' J/\psi)$ from $\sqrt{s} = 4.18$ to 4.60 GeV assuming interfering $\psi(4160)$ and $\psi(4260)$ contributions. At $\sqrt{s} = 4.23$ GeV, $\sigma(e^+e^- \rightarrow \eta' J/\psi) = 3.6 \pm 0.6 \pm 0.3$ pb.

² Solution I of the fit, corresponding to a phase of -0.03 ± 0.44 rad.

³ Solution II of the fit, corresponding to a phase of 2.54 ± 0.04 rad.

NODE=M074R34
NODE=M074R34

OCCUR=2

NODE=M074R34;LINKAGE=A

NODE=M074R34;LINKAGE=B

NODE=M074R34;LINKAGE=C

 $\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.59 ± 0.75		¹ ABLIKIM	21AJ	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.63 ± 0.78		² ABLIKIM	21AJ	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
0.02 ± 0.01		³ ABLIKIM	21AJ	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.6 ± 1.3		⁴ ABLIKIM	19K	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
1.8 ± 1.4		⁵ ABLIKIM	19K	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
<4.3	90	⁶ LIU	08H	RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$
$7.4^{+2.1}_{-1.7}$		⁷ LIU	08H	RVUE	$10.58 e^+e^- \rightarrow \psi(2S)\pi^+\pi^-\gamma$

¹ Solution I of four equivalent solutions in a fit using three interfering resonances.

² Solution II of four equivalent solutions in a fit using three interfering resonances

³ Solutions III and IV of four equivalent solutions in a fit using three interfering resonances.

⁴ Solution I of two equivalent solutions in a fit using two interfering resonances.

⁵ Solution II of two equivalent solutions in a fit using two interfering resonances.

⁶ For constructive interference with the $\psi(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

⁷ For destructive interference with the $\psi(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.

NODE=M074G7
NODE=M074G7

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

NODE=M074G7;LINKAGE=A

NODE=M074G7;LINKAGE=B

NODE=M074G7;LINKAGE=C

NODE=M074G7;LINKAGE=AA

NODE=M074G7;LINKAGE=BB

NODE=M074G7;LINKAGE=LI

NODE=M074G7;LINKAGE=LU

 $\Gamma(\chi_{c0}\omega) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

$2.5 \pm 0.2 \pm 0.3$ ¹ ABLIKIM 19AI BES3 $e^+e^- \rightarrow \omega\chi_{c0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.7 \pm 0.5 \pm 0.4$ 180 ² ABLIKIM 15C BES3 $e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a fit of the measured cross section from $\sqrt{s} = 4.178$ – 4.278 GeV. Supersedes ABLIKIM 15C.

² From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21$ – 4.42 GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M074G05
NODE=M074G05

NODE=M074G05;LINKAGE=B

NODE=M074G05;LINKAGE=A

 $\Gamma(h_c(1P)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

$4.6^{+2.9}_{-1.4} \pm 0.8$ ABLIKIM 17G BES3 $e^+e^- \rightarrow \pi^+\pi^-h_c$

NODE=M074R47
NODE=M074R47

 $\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{23}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.4 90 AUBERT,BE 06D BABR $10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

NODE=M074G2
NODE=M074G2

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	¹ AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
¹ AUBERT 07AK reports $[\Gamma(\psi(4230) \rightarrow \phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(\psi(4230) \rightarrow e^+ e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+ K^-)] < 0.14 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+ K^-) = 49.1 \times 10^{-2}$.				

NODE=M074G6
NODE=M074G6

NODE=M074G6;LINKAGE=AU

$$\Gamma(\phi K^+ K^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.75	90	ABLIKIM	23AE BES3	$e^+ e^- \rightarrow \phi K^+ K^-$

NODE=M074R63
NODE=M074R63

$$\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{26}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	ABLIKIM	23AE BES3	$e^+ e^- \rightarrow \phi K_S^0 K_S^0$

NODE=M074R64
NODE=M074R64

$$\Gamma(\phi \eta') \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{28}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.53	90	ABLIKIM	23R BES3	$e^+ e^- \rightarrow \phi \eta'$

NODE=M074R61
NODE=M074R61

$$\Gamma(D^{*0} D^{*-} \pi^+) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{44}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

5 to 22	¹ ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$

¹ From a cross-section measurement of $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. Depending on solutions I – VIII with the same fit qualities.

NODE=M074R65
NODE=M074R65

NODE=M074R65;LINKAGE=A

$$\Gamma(\omega \pi^+ \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{51}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.487 \pm 0.008 \pm 0.030$	^{1,2} ABLIKIM	23AQ BES3	fit to cross sections
$0.0005 \pm 0.0003 \pm 0.0001$	^{2,3} ABLIKIM	23AQ BES3	fit to cross sections

¹ Solution I of the fit.

² From a fit to $e^+ e^- \rightarrow \omega \pi^+ \pi^-$ cross sections between 4 and 4.6 GeV. Recalculated from $12 \pi \Gamma(e^+ e^-) B(\psi(4230) \rightarrow \omega \pi^+ \pi^-)$. First uncertainty is from statistical and uncommon systematic uncertainties, and the second is a 6.2% common systematic uncertainty quoted in the paper.

³ Solution II of the fit.

NODE=M074R62
NODE=M074R62

OCCUR=2

NODE=M074R62;LINKAGE=A
NODE=M074R62;LINKAGE=C

NODE=M074R62;LINKAGE=B

$$\Gamma(\Xi^- \Xi^+) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{53}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.0251 (CL = 90%) [$<2.7 \times 10^{-4} \text{ eV}$ (CL = 90%) OUR 2023 BEST LIMIT]

<0.0251	90	¹ ABLIKIM	23BK BES3	$e^+ e^- \rightarrow \psi(4230)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<2.7 \times 10^{-4}$	90	² ABLIKIM	20C BES3	$e^+ e^- \rightarrow \Xi^- \Xi^+$

¹ From a fit to $e^+ e^- \rightarrow \Xi^- \Xi^+$ cross sections.

² Superseded by ABLIKIM 23BK.

NODE=M074R35
NODE=M074R35

NODE=M074R35;LINKAGE=A
NODE=M074R35;LINKAGE=B

$$\Gamma(\pi^+ \pi^+ \pi^- \pi^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{54}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<32 90 | ABLIKIM | 21AW BES3 | $e^+ e^- \rightarrow 2\pi^+ 2\pi^-$ |

NODE=M074R37
NODE=M074R37

$$\Gamma(\pi^+ \pi^+ \pi^- \pi^- \pi^0) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{55}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<16 90 | ABLIKIM | 21AW BES3 | $e^+ e^- \rightarrow 2\pi^+ 2\pi^- \pi^0$ |

NODE=M074R38
NODE=M074R38

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}} \quad \Gamma_{58}\Gamma_1/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.04 \pm 0.19 \pm 0.09$	¹ ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
$0.0027 \pm 0.0023 \pm 0.0001$	² ABLIKIM	19AE BES3	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
$< 0.5 \text{ at } 90\% \text{ CL}$	AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M074G4
NODE=M074G4

OCCUR=2

¹ Solution I of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

² Solution II of the fit including the $\psi(4160)$ with mass 4191 ± 5 MeV and width 70 ± 10 MeV from PDG 16 and the $\psi(4230)$ with mass $4219.6 \pm 3.3 \pm 5.1$ MeV and width $56.0 \pm 3.6 \pm 6.9$ MeV from GAO 17.

NODE=M074G4;LINKAGE=A

NODE=M074G4;LINKAGE=B

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{59} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	ABLIKIM	19	BES3 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0$

NODE=M074R31
NODE=M074R31

$$\Gamma(K_S^0 K^\pm \pi^\mp \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{60} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.19	90	ABLIKIM	19	BES3 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \eta$

NODE=M074R32
NODE=M074R32

$$\Gamma(K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{61} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.6	90	AUBERT	08S	BABR $10.6 e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M074G5
NODE=M074G5

$$\Gamma(K^+ K^- \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{62} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<20	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^-$

NODE=M074R39
NODE=M074R39

$$\Gamma(K^+ K^- \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{63} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<43	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M074R40
NODE=M074R40

$$\Gamma(K^+ K^+ K^- K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{64} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.8	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow 2K^+ 2K^-$

NODE=M074R41
NODE=M074R41

$$\Gamma(K^+ K^+ K^- K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{65} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow 2K^+ 2K^- \pi^0$

NODE=M074R42
NODE=M074R42

$$\Gamma(p \bar{p} \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{66} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<7.2	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow p \bar{p} \pi^+ \pi^-$

NODE=M074R43
NODE=M074R43

$$\Gamma(p \bar{p} \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{67} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	ABLIKIM	21AW	BES3 $e^+ e^- \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$

NODE=M074R44
NODE=M074R44

$$\Gamma(\Lambda \bar{\Lambda}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{69} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.8 $\times 10^{-3}$	90	¹ ABLIKIM	21AS	BES3 $e^+ e^- \rightarrow \psi(4260)$

¹ From a measurement of the $e^+ e^- \rightarrow \Lambda \bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M074R36
NODE=M074R36

NODE=M074R36;LINKAGE=A

$$\Gamma(p K^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{70} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 $\times 10^{-3}$	90	¹ ABLIKIM	23BL	BES3 $e^+ e^- \rightarrow \psi(4230)$

¹ From a fit to $e^+ e^- \rightarrow p K^- \bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M074R67
NODE=M074R67

NODE=M074R67;LINKAGE=A

$$\Gamma(\chi_{c1} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{73} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ HAN	15	BELL $10.58 e^+ e^- \rightarrow \chi_{c1} \gamma$

¹ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G03
NODE=M074G03

NODE=M074G03;LINKAGE=A

$$\Gamma(\chi_{c2} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{74} \Gamma_1 / \Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.0	90	¹ HAN	15	BELL $10.58 e^+ e^- \rightarrow \chi_{c2} \gamma$

¹ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G04
NODE=M074G04

NODE=M074G04;LINKAGE=A

$\psi(4230) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M074245

$\Gamma(D^0 D^{*+}(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{41}/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%
$<0.42 \times 10^{-6}$	90
DOCUMENT ID	TECN
1 PAKHLOVA	09 BELL
COMMENT	
$e^+e^- \rightarrow D^0 D^{*-} \pi^+$	
¹ Using 4263^{+8}_{-9} MeV for the mass of $\psi(4260)$.	

NODE=M074R11
NODE=M074R11

NODE=M074R11;LINKAGE=PA

 $\psi(4230) \text{ BRANCHING RATIOS}$

NODE=M074225

$\Gamma(\eta_c(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE	DOCUMENT ID
not seen	1 ABLIKIM
	21B BES3
	COMMENT
	$e^+e^- \rightarrow \pi^+\pi^-\eta_c$
¹ Not seen in $e^+e^- \rightarrow \pi^+\pi^-\eta_c$ at $\sqrt{s} = 4.226$ GeV with a 90% C.L. upper limit on the cross section of 16.8 pb.	

NODE=M074R56
NODE=M074R56

NODE=M074R56;LINKAGE=A

$\Gamma(\eta_c(1S)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE	DOCUMENT ID
seen	1 ABLIKIM
	21B BES3
	COMMENT
	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$
¹ Seen as a peak in the $e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c$ cross section with a peak value of $46.1^{+9.5}_{-9.4} \pm 6.6$ pb at $\sqrt{s} = 4.226$ GeV.	

NODE=M074R55
NODE=M074R55

NODE=M074R55;LINKAGE=A

$\Gamma(J/\psi\pi^+\pi^-)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE	DOCUMENT ID
seen	1 ABLIKIM
	22AMBES3
	COMMENT
	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
seen	2 ABLIKIM
	17B BES3
	COMMENT
	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$
¹ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV.	
² From a three-resonance fit. Superseded by ABLIKIM 22AM.	

NODE=M074R51
NODE=M074R51

NODE=M074R51;LINKAGE=A

NODE=M074R51;LINKAGE=B

$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$	Γ_6/Γ_5
VALUE	DOCUMENT ID
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.17 ± 0.13	1 LEES
	12AC BABR
	COMMENT
	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
¹ Systematic uncertainties not estimated.	

NODE=M074R02
NODE=M074R02

NODE=M074R02;LINKAGE=LE

$\Gamma(T_{cc1}(3900)^\pm\pi^\mp, T_{cc1}^\pm \rightarrow J/\psi\pi^\pm)/\Gamma(J/\psi\pi^+\pi^-)$	Γ_7/Γ_5
VALUE	DOCUMENT ID
$0.215 \pm 0.033 \pm 0.075$	1 ABLIKIM
	13T BES3
	COMMENT
	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •	
0.29 ± 0.08	2 LIU
	13B BELL
	COMMENT
	$e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
¹ Assuming that the cross section of $e^+e^- \rightarrow \pi^+\pi^-J/\psi$ is fully due to the $\psi(4260)$.	
² Systematic error not evaluated.	

NODE=M074R01
NODE=M074R01NODE=M074R01;LINKAGE=AB
NODE=M074R01;LINKAGE=A

$\Gamma(J/\psi\pi^0\pi^0)/\Gamma_{\text{total}}$	Γ_8/Γ
VALUE	DOCUMENT ID
seen	1 ABLIKIM
	20N BES3
	COMMENT
	$e^+e^- \rightarrow \pi^0\pi^0J/\psi$
¹ From a fit to the cross section $e^+e^- \rightarrow \pi^0\pi^0J/\psi$ at center-of-mass energies between 3.808 and 4.600 GeV.	

NODE=M074R50
NODE=M074R50

NODE=M074R50;LINKAGE=A

$\Gamma(J/\psi K_S^0 K_S^0)/\Gamma_{\text{total}}$	Γ_{10}/Γ
VALUE	DOCUMENT ID
not seen	SHEN
	14 BELL
	COMMENT
	$9.4\text{--}10.9 e^+e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

NODE=M074R27
NODE=M074R27

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$	Γ_{11}/Γ
VALUE	DOCUMENT ID
seen	ABLIKIM
	200 BES3
	COMMENT
	$e^+e^- \rightarrow \eta J/\psi$

NODE=M074R52
NODE=M074R52

$\Gamma(J/\psi\eta\pi^0)/\Gamma_{\text{total}}$	Γ_{15}/Γ
VALUE	DOCUMENT ID
not seen	ABLIKIM
	15Q BES3
	COMMENT
	$4.0\text{--}4.6 e^+e^- \rightarrow J/\psi\eta\pi^0$

NODE=M074R28
NODE=M074R28

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$

¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .

NODE=M074R53
NODE=M074R53

NODE=M074R53;LINKAGE=A

 $\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{17}/Γ_5

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

($0.11 \pm 0.03 \pm 0.03$) to ($0.55 \pm 0.18 \pm 0.19$)	¹ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$ or $\psi(2S)$

¹ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^-J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.

NODE=M074R30
NODE=M074R30

NODE=M074R30;LINKAGE=A

 $\Gamma(\chi_{c0}\omega)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	180	¹ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42 \text{ GeV}$ to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

NODE=M074R48
NODE=M074R48

NODE=M074R48;LINKAGE=A

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

NODE=M074R49
NODE=M074R49

 $\Gamma(h_c(1P)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{22}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ PEDLAR	11 CLEO	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

¹ At $\sqrt{s} = 4260 \text{ MeV}$, PEDLAR 11 measures $\sigma(e^+e^- \rightarrow h_c(1P)\pi^+\pi^-) = 32 \pm 17 \pm 6 \pm 6 \text{ pb}$, where the errors are statistical, systematic, and due to uncertainty in $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$, respectively.

NODE=M074R25
NODE=M074R25

NODE=M074R25;LINKAGE=PE

 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	23BT BES3	$e^+e^- \rightarrow \phi\eta$

NODE=M074R68
NODE=M074R68

 $\Gamma(D\bar{D})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{29}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ AUBERT	07BE BABR	$e^+e^- \rightarrow D\bar{D}\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.0	90	CRONIN-HEN..09	CLEO	e^+e^-

¹ Using $4259 \pm 10 \text{ MeV}$ for the mass and $88 \pm 24 \text{ MeV}$ for the width of $\psi(4260)$.

NODE=M074R2
NODE=M074R2

NODE=M074R2;LINKAGE=AU

 $\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^0\bar{D}^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M074R12
NODE=M074R12

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^+D^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^+D^-\gamma$
not seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^+D^-\gamma$

NODE=M074R13
NODE=M074R13

 $\Gamma(D^*\bar{D}^* + \text{c.c.})/\Gamma(J/\psi\pi^+\pi^-)$ Γ_{32}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<34	90	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}^*$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<45	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R03
NODE=M074R03

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{33}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^0 \gamma$

NODE=M074R14
NODE=M074R14

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^-$
not seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^- \gamma$

NODE=M074R15
NODE=M074R15

$$\Gamma(D^* \bar{D}^*)/\Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{35}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	CRONIN-HEN..09	CLEO	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<40	90	AUBERT	09M BABR	$e^+ e^- \rightarrow \gamma D^* \bar{D}^*$

NODE=M074R04
NODE=M074R04

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

 Γ_{36}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*0} \bar{D}^{*0} \gamma$

NODE=M074R17
NODE=M074R17

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$$

 Γ_{37}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^{*+} D^{*-}$
not seen	PAKHLOVA 07	BELL	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	AUBERT	09M BABR	$e^+ e^- \rightarrow D^{*+} D^{*-} \gamma$

NODE=M074R18
NODE=M074R18

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

 Γ_{39}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
NODE=M074R16

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

 Γ_{40}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
NODE=M074R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{40}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
NODE=M074R05

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{41}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM 19R	BES3	$e^+ e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M074R54
NODE=M074R54

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$$

 Γ_{41}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D_1(2420) \bar{D} + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{42}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 19AR	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$

NODE=M074R33
NODE=M074R33

¹ Results from a measurement of $\sigma(e^+ e^- \rightarrow D_1(2420) \bar{D} + \text{c.c.})$ between $\sqrt{s} = 4.3$ and 4.6 GeV.

NODE=M074R33;LINKAGE=A

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma_{\text{total}}$$

 Γ_{43}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen [not seen OUR 2023 BEST LIMIT]			
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^*\bar{D}^*\pi)/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{43}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	e^+e^-

NODE=M074R06
NODE=M074R06

$$\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}$$

 Γ_{45}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen DEL-AMO-SA..10N BABR $e^+e^- \rightarrow D_s^+ D_s^- \gamma$

not seen CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D_s^+ D_s^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen PAKHLOVA 11 BELL $e^+e^- \rightarrow D_s^+ D_s^- \gamma$

NODE=M074R19
NODE=M074R19

$$\Gamma(D_s^+ D_s^-)/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{45}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.7 95 DEL-AMO-SA..10N BABR $10.6 e^+e^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.3 90 CRONIN-HEN..09 CLEO e^+e^-

NODE=M074R07
NODE=M074R07

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

 Γ_{46}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen DEL-AMO-SA..10N BABR $e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$

not seen CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D_s^{*+} D_s^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen PAKHLOVA 11 BELL $e^+e^- \rightarrow D_s^{*+} D_s^- \gamma$

NODE=M074R20
NODE=M074R20

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{46}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 0.8 90 CRONIN-HEN..09 CLEO e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

<44 95 DEL-AMO-SA..10N BABR $10.6 e^+e^-$

NODE=M074R08
NODE=M074R08

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}$$

 Γ_{47}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen CRONIN-HEN..09 CLEO $e^+e^- \rightarrow D_s^{*+} D_s^{*-}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen PAKHLOVA 11 BELL $e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

not seen DEL-AMO-SA..10N BABR $e^+e^- \rightarrow D_s^{*+} D_s^{*-} \gamma$

NODE=M074R21
NODE=M074R21

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{47}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 9.5 90 CRONIN-HEN..09 CLEO e^+e^-

• • • We do not use the following data for averages, fits, limits, etc. • • •

<30 95 DEL-AMO-SA..10N BABR $10.6 e^+e^-$

NODE=M074R09
NODE=M074R09

$$\Gamma(p\bar{p})/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{48}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.13 90 ¹ AUBERT 06B BABR $e^+e^- \rightarrow p\bar{p}\gamma$

¹ Using 4259 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $\psi(4260)$.

NODE=M074R1
NODE=M074R1

NODE=M074R1;LINKAGE=AU

$$\Gamma(p\bar{p}\pi^0)/\Gamma(J/\psi\pi^+\pi^-)$$

 Γ_{49}/Γ_5

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2 × 10⁻⁴ 90 ABLIKIM 17F BES3 $e^+e^- \rightarrow \psi(4260) \rightarrow$
hadrons

NODE=M074R00
NODE=M074R00

OCCUR=2

$$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$$

 Γ_{50}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ABLIKIM 21AN BES3 $e^+e^- \rightarrow p\bar{p}\eta$

NODE=M074R45
NODE=M074R45

$$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$$

 Γ_{52}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ABLIKIM 21AN BES3 $e^+e^- \rightarrow p\bar{p}\omega$

NODE=M074R46
NODE=M074R46

$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$

VALUE

not seen

DOCUMENT ID

ABLIKIM

TECN

22K BES3

COMMENT

 $e^+e^- \rightarrow \omega\pi^0$ Γ_{56}/Γ NODE=M074R59
NODE=M074R59 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$

VALUE

not seen

DOCUMENT ID

ABLIKIM

TECN

22K BES3

COMMENT

 $e^+e^- \rightarrow \omega\eta$ Γ_{57}/Γ NODE=M074R60
NODE=M074R60 $\Gamma(p\bar{p}p\bar{p})/\Gamma_{\text{total}}$

VALUE

not seen

DOCUMENT ID

ABLIKIM

TECN

21D BES3

COMMENT

 $4.0\text{--}4.6\ e^+e^- \rightarrow p\bar{p}p\bar{p}$ Γ_{68}/Γ NODE=M074R58
NODE=M074R58

Radiative decays

 $\Gamma(\eta_c(1S)\gamma)/\Gamma_{\text{total}}$

VALUE

possibly seen

DOCUMENT ID

¹ ABLIKIM

COMMENT

17W $e^+e^- \rightarrow \gamma\eta_c(1S)$ Γ_{71}/Γ NODE=M074R29
NODE=M074R29¹ Significance ranges from 4.2 σ to as low as 1.5 σ for a flat component plus $\psi(4260)$ spectrum. Needs confirmation.

NODE=M074R29;LINKAGE=A

 $\Gamma(\eta_c(1S)\pi^0\gamma)/\Gamma_{\text{total}}$

VALUE

not seen

DOCUMENT ID

¹ ABLIKIM

TECN

21B BES3

COMMENT

 $e^+e^- \rightarrow \gamma\pi^0\eta_c$ Γ_{72}/Γ NODE=M074R57
NODE=M074R57¹ Not seen in $e^+e^- \rightarrow \gamma\pi^0\eta_c$ at $\sqrt{s} = 4.226$ GeV with a 90% C.L. upper limit on the cross section of 11.2 pb.

NODE=M074R57;LINKAGE=A

 $\Gamma(\chi_{c1}(3872)\gamma)/\Gamma_{\text{total}}$

VALUE EVTS

seen

seen

20 $\pm$ 5

DOCUMENT ID

ABLIKIM

TECN

19v BES3

COMMENT

 $e^+e^- \rightarrow \gamma\chi_{c1}(3872)$ $J/\psi\pi^+\pi^-\gamma$ Γ_{75}/Γ NODE=M074R26
NODE=M074R26 $\psi(4230)$ REFERENCES

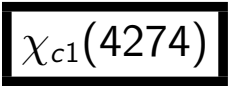
NODE=M074

ABLIKIM	23AE	PR D108 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62092
ABLIKIM	23AQ	JHEP 2308 159	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62313
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	23BT	PR D108 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62516
ABLIKIM	23R	PR D107 072003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62062
ABLIKIM	23U	PR D107 092005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62065
ABLIKIM	23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62072
ABLIKIM	22AM	PR D106 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61885
ABLIKIM	22AU	CP C46 111002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61896
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61441
ABLIKIM	21AN	PR D104 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61446
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61454
ABLIKIM	21AW	PR D104 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61479
ABLIKIM	21B	PR D103 032006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61029
ABLIKIM	21D	PR D103 052003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61031
ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60210
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60744
ABLIKIM	20C	PRL 124 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60215
ABLIKIM	20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60338
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60344
ABLIKIM	19	PR D99 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59515
ABLIKIM	19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59856
ABLIKIM	19AI	PR D99 091103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59871
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ABLIKIM	19K	PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	19R	PRL 122 102002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59765
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59796
ABLIKIM	18N	PR D97 071101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58914
ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57755
ABLIKIM	17F	PL B771 45	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57909
ABLIKIM	17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57915
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58029
Also		PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	17W	PR D96 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58212
GAO	17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan		REFID=57991
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang		REFID=58219
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan		REFID=58463
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)	REFID=57140
ABLIKIM	15C	PRL 114 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56401
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56782
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
ABLIKIM	14	PRL 112 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55647

SHEN	14	PR D89 072015	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PEDLAR	11	PRL 107 041803	T. Pedlar <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CRONIN-HEN...	09	PR D80 072001	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)
AUBERT,B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=55944
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NODE=M233



$$I^G(J^{PC}) = 0^+(1^{++})$$

was $X(4274)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M233

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c1} K^+$, $\chi_{c1} \rightarrow J/\psi \phi$ using an am-
plitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting
for systematic uncertainties) of 6.0 σ .

$\chi_{c1}(4274)$ MASS

NODE=M233M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4286 $^{+8}_{-9}$ OUR AVERAGE	Error includes scale factor of 1.7.			
4294 ± 4 $^{+3}_{-6}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4274.4 $^{+8.4}_{-6.7} \pm 1.9$	22	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4273.3 ± 8.3 $^{+17.2}_{-3.6}$	4289	^{3,4} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 18 σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1 σ .				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0 σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M233M

NODE=M233M;LINKAGE=C
NODE=M233M;LINKAGE=B
NODE=M233M;LINKAGE=A
NODE=M233M;LINKAGE=D

$\chi_{c1}(4274)$ WIDTH

NODE=M233W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 7 OUR AVERAGE				
53 ± 5 ± 5	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
32.3 $^{+21.9}_{-15.3} \pm 7.6$	22	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
56 ± 11 $^{+8}_{-11}$	4289	^{3,4} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 18 σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1 σ .				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.0 σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M233W

NODE=M233W;LINKAGE=C
NODE=M233W;LINKAGE=B
NODE=M233W;LINKAGE=A
NODE=M233W;LINKAGE=D

$\chi_{c1}(4274)$ DECAY MODES

NODE=M233215;NODE=M233

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen

DESIG=1

$\chi_{c1}(4274)$ BRANCHING RATIOS

NODE=M233220

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	^{2,3} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$	
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 18 σ .					
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 6.0 σ .					
³ Superseded by AAIJ 21E.					

NODE=M233R01
NODE=M233R01

NODE=M233R01;LINKAGE=B
NODE=M233R01;LINKAGE=A
NODE=M233R01;LINKAGE=C

$\chi_{c1}(4274)$ REFERENCES

NODE=M233

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AALTONEN	17	MPL A32 1750139	T. Altonen <i>et al.</i>	(CDF Collab.)

REFID=61150
REFID=57657
REFID=57636
REFID=58161

NODE=M194

$X(4350)$

$I^G(J^{PC}) = 0^+(?^?+)$

OMITTED FROM SUMMARY TABLE
Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.

NODE=M194

$X(4350)$ MASS

NODE=M194M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4350.6^{+4.6}_{-5.1} \pm 0.7$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

NODE=M194M

NODE=M194M;LINKAGE=SH

$X(4350)$ WIDTH

NODE=M194W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$13^{+18}_{-9} \pm 4$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
¹ Statistical significance of 3.2 σ .				

NODE=M194W

NODE=M194W;LINKAGE=SH

$X(4350)$ DECAY MODES

NODE=M194215;NODE=M194

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

DESIG=1

DESIG=2

$X(4350)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M194220

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$6.7^{+3.2}_{-2.4} \pm 1.1$	$8.8^{+4.2}_{-3.2}$	¹ SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1.5^{+0.7}_{-0.6} \pm 0.3$	$8.8^{+4.2}_{-3.2}$	² SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi\phi$
¹ For $J^P = 0^+$. Statistical significance of 3.2 σ .					
² For $J^P = 2^+$. Statistical significance of 3.2 σ .					

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2

X(4350) BRANCHING RATIOS $\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

¹ Statistical significance of 3.2 σ . $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$

¹ Statistical significance of 3.2 σ .**X(4350) REFERENCES**

SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)

 $\psi(4360)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4360)$; was $X(4360)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by AUBERT 07S, WANG 07D, and LEES 14F. See also the review on "Spectroscopy of mesons containing two heavy quarks."

 $\psi(4360)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4374 $\pm$ 7 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
4371.6 $\pm$ 2.5 $\pm$ 9.2		¹ ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^- D^+ D^-$
4298 $\pm$ 12 $\pm$ 26		² ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4390.3 $\pm$ 6.0 $\pm$ 0.7		³ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4371.7 $\pm$ 7.5 $\pm$ 1.8		⁴ ABLIKIM	21AK BES3	$e^+e^- \rightarrow \gamma\chi_{c2} \rightarrow \gamma\gamma J/\psi$
4382.0 $\pm$ 13.3 $\pm$ 1.7		⁵ ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
4391.5 $^{+6.3}_{-6.8}$ $\pm$ 1.0		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
4347 $\pm$ 6 $\pm$ 3	279	⁶ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4340 $\pm$ 16 $\pm$ 9	37	⁷ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4406.9 $\pm$ 17.2 $\pm$ 4.5		⁸ ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^- \chi_{c1}\gamma$
4320.0 $\pm$ 10.4 $\pm$ 7.0		⁹ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4383.8 $\pm$ 4.2 $\pm$ 0.8		¹⁰ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4383.7 $\pm$ 2.9 $\pm$ 6.2		¹¹ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4386.4 $\pm$ 2.1 $\pm$ 6.4		¹² ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4355 $^{+9}_{-10}$ $\pm$ 9	74	¹³ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4324 $\pm$ 24		¹⁴ AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4361 $\pm$ 9 $\pm$ 9	47	⁷ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$

¹ From a fit to the cross section for $e^+e^- \rightarrow D^+D^-\pi^+\pi^-$ in the range $\sqrt{s} = 4.190\text{--}4.946$ GeV.² From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV. Parameters depend on the existence or non-existence of a state near 4.5 GeV.³ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.⁴ From a five-resonance fit to the cross section for $e^+e^- \rightarrow \gamma\gamma J/\psi \rightarrow \gamma\gamma\ell^+\ell^-$.⁵ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.⁶ From a two-resonance fit. Supersedes WANG 07D.⁷ From a two-resonance fit.⁸ From a fit to the $e^+e^- \rightarrow \pi^+\pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.⁹ From a three-resonance fit. Superseded by ABLIKIM 22AM.¹⁰ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^- \psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

NODE=M194

REFID=53235

NODE=M181

NODE=M181

NODE=M181M

NODE=M181M

NODE=M181M;LINKAGE=M

NODE=M181M;LINKAGE=L

NODE=M181M;LINKAGE=H

NODE=M181M;LINKAGE=G
NODE=M181M;LINKAGE=BA
NODE=M181M;LINKAGE=A
NODE=M181M;LINKAGE=WA
NODE=M181M;LINKAGE=J

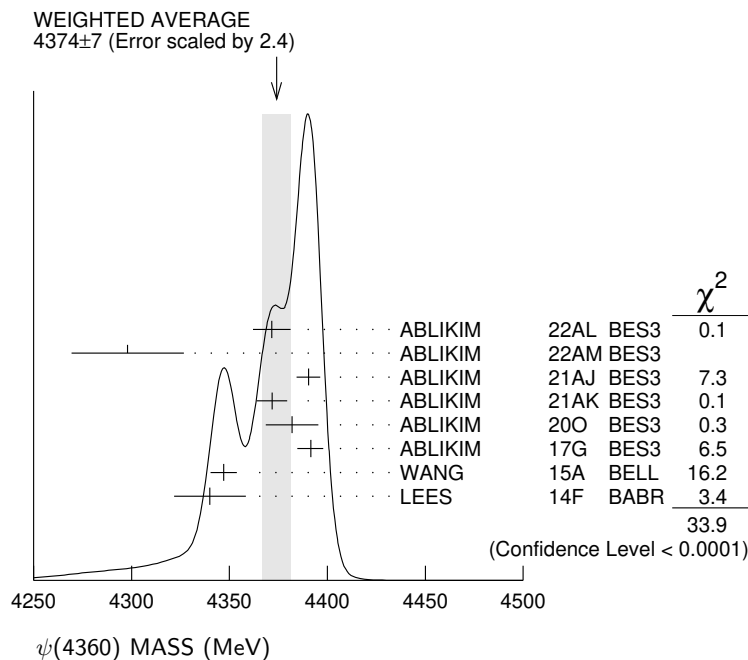
NODE=M181M;LINKAGE=K

NODE=M181M;LINKAGE=C

- 11 From a three-resonance fit.
 12 From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$ data.
 13 From a combined fit of AUBERT 07S and WANG 07D data with two resonances.
 14 From a single-resonance fit. Systematic errors not estimated.

NODE=M181M;LINKAGE=E
 NODE=M181M;LINKAGE=D

NODE=M181M;LINKAGE=LI
 NODE=M181M;LINKAGE=AU



$\psi(4360)$ WIDTH

NODE=M181W

NODE=M181W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
118 ±12 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
167 ± 4 ±29		1 ABLIKIM	22AL BES3	$e^+e^- \rightarrow \pi^+\pi^- D^+ D^-$
127 ±17 ±10		2 ABLIKIM	22AMBES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
143.3±10.0± 0.5		3 ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
51.1±17.6± 1.9		4 ABLIKIM	21AK BES3	$e^+e^- \rightarrow \gamma \chi_{c2} \rightarrow \gamma \gamma J/\psi$
135.8±60.8±22.5		5 ABLIKIM	20O BES3	$e^+e^- \rightarrow \eta J/\psi$
139.5 ^{+16.2} _{-20.6} ± 0.6		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
103 ± 9 ± 5	279	6 WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
94 ±32 ±13	37	7 LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
128.1±37.2± 2.3		8 ABLIKIM	22R BES3	$e^+e^- \rightarrow \pi^+\pi^- \chi_{c1} \gamma$
101.4 ^{+25.3} _{-19.7} ±10.2		9 ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
84.2±12.5± 2.1		10 ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
94.2± 7.3± 2.0		11 ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
96.0± 6.7± 2.7		12 ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
103 ⁺¹⁷ ₋₁₅ ±11	74	13 LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
172 ±33		14 AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$
74 ±15 ±10	47	7 WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^- \psi(2S)$

- 1 From a fit to the cross section for $e^+e^- \rightarrow D^+ D^- \pi^+ \pi^-$ in the range $\sqrt{s} = 4.190\text{--}4.946$ GeV.
 2 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 3.7730\text{--}4.7008$ GeV. Parameters depend on the existence or non-existence of a state near 4.5 GeV.
 3 From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.
 4 From a five-resonance fit to the cross section for $e^+e^- \rightarrow \gamma \gamma J/\psi \rightarrow \gamma \gamma \ell^+ \ell^-$.
 5 From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.
 6 From a two-resonance fit. Supersedes WANG 07D.
 7 From a two-resonance fit.
 8 From a fit to the $e^+e^- \rightarrow \pi^+\pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.
 9 From a three-resonance fit. Superseded by ABLIKIM 22AM.

NODE=M181W;LINKAGE=L

NODE=M181W;LINKAGE=K

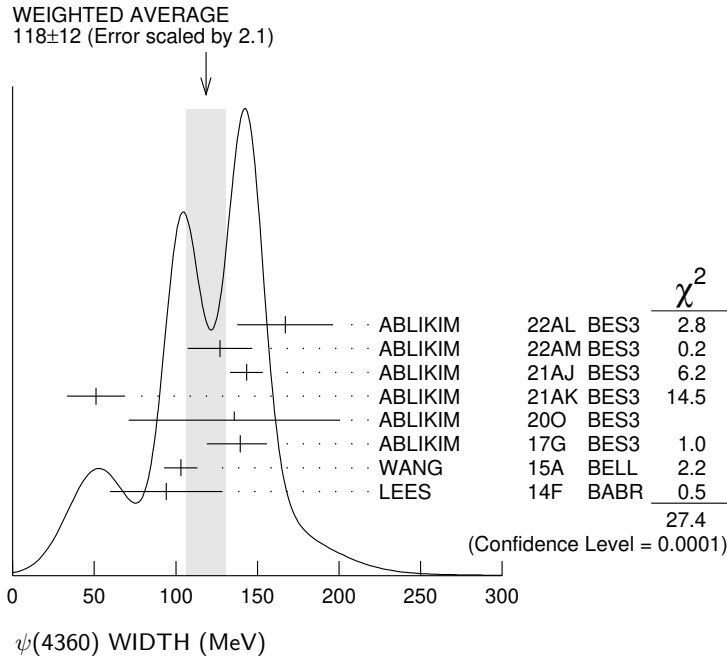
NODE=M181W;LINKAGE=G

NODE=M181W;LINKAGE=F
 NODE=M181W;LINKAGE=BA
 NODE=M181W;LINKAGE=A
 NODE=M181W;LINKAGE=WA
 NODE=M181W;LINKAGE=I

NODE=M181W;LINKAGE=J

- ¹⁰ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} . Superseded by ABLIKIM 21AJ.
- ¹¹ From a three-resonance fit.
- ¹² From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^-J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- ¹³ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.
- ¹⁴ From a single-resonance fit. Systematic errors not estimated.

NODE=M181W;LINKAGE=C

NODE=M181W;LINKAGE=E
NODE=M181W;LINKAGE=DNODE=M181W;LINKAGE=LI
NODE=M181W;LINKAGE=AU **$\psi(4360)$ DECAY MODES**

NODE=M181215;NODE=M181

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	seen
Γ_2 $h_c\pi^+\pi^-$	seen
Γ_3 $J/\psi\pi^+\pi^-$	seen
Γ_4 $\psi(2S)\pi^+\pi^-$	seen
Γ_5 $\psi(3770)\pi^+\pi^-$	possibly seen
Γ_6 $\psi_2(3823)\pi^+\pi^-$	seen
Γ_7 $J/\psi\eta$	seen
Γ_8 $D^0D^{*-}\pi^+$	not seen
Γ_9 $D^+D^-\pi^+\pi^-$	seen
Γ_{10} $D_1(2420)\bar{D} + \text{c.c.}$	possibly seen
Γ_{11} $\phi\eta$	not seen
Γ_{12} $\omega\pi^0$	not seen
Γ_{13} $\omega\eta$	not seen
Γ_{14} $p\bar{p}\eta$	not seen
Γ_{15} $p\bar{p}\omega$	not seen
Γ_{16} $\chi_{c1}\gamma$	not seen
Γ_{17} $\chi_{c2}\gamma$	not seen
Γ_{18} $\Xi^-\Xi^+$	not seen
Γ_{19} $pK^-\bar{\Lambda} + \text{c.c.}$	not seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=12

DESIG=8;OUR EVAL;→ UNCHECKED ←

DESIG=2

DESIG=11

DESIG=5

DESIG=4

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=17

DESIG=10

DESIG=20

DESIG=15

DESIG=16

DESIG=13

DESIG=14

DESIG=6;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=18;OUR EVAL;→ UNCHECKED ←

DESIG=19;OUR EVAL;→ UNCHECKED ←

 $\psi(4360) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M181230

$\Gamma(h_c\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
$11.6^{+5.0}_{-4.4} \pm 1.9$	ABLIKIM 17G BES3 $e^+e^- \rightarrow \pi^+\pi^-h_c$

NODE=M181R11
NODE=M181R11

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10.7±4.1		¹ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
20.7±2.5		² ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
9.9±4.1		³ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
19.4±2.0		⁴ ABLIKIM	21AJ BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
7.3±2.8		⁵ ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
11.0±3.8		⁶ ABLIKIM	19K BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
9.2±0.6±0.6	279	⁷ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.9±0.6±0.7	279	⁸ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
6.0±1.0±0.5	37	⁵ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
7.2±1.0±0.6	37	⁶ LEES	14F BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.1 ^{+1.3} _{-1.2}	74	⁹ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
12.3±1.2	74	¹⁰ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.4±1.7±1.5	47	⁵ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.8±1.8±1.4	47	⁶ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

NODE=M181G1
 NODE=M181G1

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Solution I of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

² Solution II of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

³ Solution III of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

⁴ Solution IV of four equivalent solutions in a fit using three interfering resonances. Supersedes ABLIKIM 19K.

⁵ Solution I of two equivalent solutions in a fit using two interfering resonances.

⁶ Solution II of two equivalent solutions in a fit using two interfering resonances.

⁷ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.

⁸ Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.

⁹ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

¹⁰ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M181G1;LINKAGE=E

NODE=M181G1;LINKAGE=F

NODE=M181G1;LINKAGE=G

NODE=M181G1;LINKAGE=H

NODE=M181G1;LINKAGE=WA

NODE=M181G1;LINKAGE=WN

NODE=M181G1;LINKAGE=A

NODE=M181G1;LINKAGE=B

NODE=M181G1;LINKAGE=LI

NODE=M181G1;LINKAGE=LU

 $\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.4±2.2		¹ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.5±1.0		² ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.7±1.1		³ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
<6.8	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M181G01
 NODE=M181G01

OCCUR=2

OCCUR=3

¹ Solution 1 of three equivalent fit solutions using three resonant structures.

² Solution 2 of three equivalent fit solutions using three resonant structures.

³ Solution 3 of three equivalent fit solutions using three resonant structures.

NODE=M181G01;LINKAGE=A

NODE=M181G01;LINKAGE=B

NODE=M181G01;LINKAGE=C

 $\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{16}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.57	90	¹ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

NODE=M181G02
 NODE=M181G02

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M181G02;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.9	90	¹ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M181G03
 NODE=M181G03

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M181G03;LINKAGE=A

 $\Gamma(\Xi^-\Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.0448	90	¹ ABLIKIM	23BK BES3	$e^+e^- \rightarrow \psi(4360)$

NODE=M181R15
 NODE=M181R15

¹ From a fit to $e^+e^- \rightarrow \Xi^-\Xi^+$ cross sections.

NODE=M181R15;LINKAGE=A

 $\Gamma(pK^-\bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.7 × 10 ⁻³	90	¹ ABLIKIM	23BL BES3	$e^+e^- \rightarrow \psi(4360)$

NODE=M181R17
 NODE=M181R17

¹ From a fit to $e^+e^- \rightarrow pK^-\bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M181R17;LINKAGE=A

$\psi(4360)$ BRANCHING RATIOS

$$\Gamma(h_c \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	17G BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M181225

NODE=M181R08
NODE=M181R08

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	17V BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$

NODE=M181R00
NODE=M181R00

¹ From a fit to the cross section for $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S) \rightarrow 2(\pi^+ \pi^-) \ell^+ \ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .

NODE=M181R00;LINKAGE=A

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_4 / \Gamma_3$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			

($0.81 \pm 0.12 \pm 0.13$) to ($42 \pm 15 \pm 15$) ¹ ZHANG 17C RVUE $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$

NODE=M181R04
NODE=M181R04

¹ From a combined fit of BELLE, BABAR and BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ and $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$ data.

NODE=M181R04;LINKAGE=A

$$\Gamma(\psi(3770) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	¹ ABLIKIM	19AR BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$

NODE=M181R06
NODE=M181R06

¹ Observe $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3770)$ at $\sqrt{s} = 4.26, 4.36$, and 4.42 GeV but cannot establish if continuum or resonant.

NODE=M181R06;LINKAGE=A

$$\Gamma(\psi_2(3823) \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		¹ ABLIKIM	22R BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

NODE=M181R03
NODE=M181R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen 19 ² ABLIKIM 15S BES3 $e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

¹ From a fit to the $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances.

NODE=M181R03;LINKAGE=C

² From a fit of $e^+ e^- \rightarrow \pi^+ \pi^- \psi_2(3823)$, $\psi_2(3823) \rightarrow \chi_{c1} \gamma$ cross sections taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4360)$ line shape.

NODE=M181R03;LINKAGE=A

$$\Gamma(J/\psi \eta) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	200 BES3	$e^+ e^- \rightarrow \eta J/\psi$

NODE=M181R07
NODE=M181R07

¹ With a significance of 6.0σ .

NODE=M181R07;LINKAGE=A

$$\Gamma(D^0 D^{*-} \pi^+) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma \times \Gamma_1 / \Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 0.72 \times 10^{-6}$	90	¹ PAKHLOVA	09 BELL	$e^+ e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R02
NODE=M181R02

¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of $\psi(4360)$.

NODE=M181R02;LINKAGE=PA

$$\Gamma(D^0 D^{*-} \pi^+) / \Gamma(\psi(2S) \pi^+ \pi^-) \quad \Gamma_8 / \Gamma_4$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8	90	PAKHLOVA	09 BELL	$e^+ e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R01
NODE=M181R01

$$\Gamma(D^+ D^- \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	22AL BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D^+ D^-$

NODE=M181R14
NODE=M181R14

¹ From a fit to the cross section for $e^+ e^- \rightarrow D^+ D^- \pi^+ \pi^-$ in the range $\sqrt{s} = 4.190\text{--}4.946$ GeV.

NODE=M181R14;LINKAGE=A

$$\Gamma(D_1(2420) \bar{D} + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{10} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	¹ ABLIKIM	19AR BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$

NODE=M181R05
NODE=M181R05

¹ Evidence for $e^+ e^- \rightarrow D_1(2420) \bar{D} + \text{c.c.}$ between $\sqrt{s} = 4.3$ and 4.6 GeV, not necessarily resonant.

NODE=M181R05;LINKAGE=A

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$				Γ_{11}/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	ABLIKIM	23BT BES3	$e^+e^- \rightarrow \phi\eta$		NODE=M181R18 NODE=M181R18
$\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$				Γ_{12}/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\pi^0$		NODE=M181R12 NODE=M181R12
$\Gamma(\omega\eta)/\Gamma_{\text{total}}$				Γ_{13}/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\eta$		NODE=M181R13 NODE=M181R13
$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$				Γ_{14}/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	ABLIKIM	21AN BES3	$e^+e^- \rightarrow p\bar{p}\eta$		NODE=M181R09 NODE=M181R09
$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$				Γ_{15}/Γ	
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	ABLIKIM	21AN BES3	$e^+e^- \rightarrow p\bar{p}\omega$		NODE=M181R10 NODE=M181R10

$\psi(4360)$ REFERENCES

ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62437
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62438
ABLIKIM	23BT	PR D108 112011	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62516
ABLIKIM	22AL	PR D106 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61884
ABLIKIM	22AM	PR D106 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61885
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61648
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61664
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61441
ABLIKIM	21AK	PR D104 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61443
ABLIKIM	21AN	PR D104 092008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61446
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60344
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ABLIKIM	19K	PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57755
ABLIKIM	17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57915
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58029
Also		PR D99 019903 (err.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59611
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang		REFID=58219
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan		REFID=58463
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56784
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)	REFID=56816
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=56839
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55938
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=53143
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959

NODE=M181

$\psi(4415)$

$$J^{PC} = 0^-(1^{--})$$

NODE=M073

 $\psi(4415)$ MASS

NODE=M073M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4415 ± 5 OUR AVERAGE			
[4415 ± 8 MeV OUR 2023 AVERAGE]			
4414.6 ± 3.4 ± 6.1	ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
4415.1 ± 7.9	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4412 ± 15	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4411 ± 7	³ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
4425 ± 6	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4429 ± 9	⁵ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4417 ± 10	BRANDELIK	78C DASP	e^+e^-
4414 ± 7	SIEGRIST	76 MRK1	e^+e^-
¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
³ Systematic uncertainties not estimated.			
⁴ From a fit to Crystal Ball (OSTERHELD 86) data.			
⁵ From a fit to BES (BAI 02C) data.			

NODE=M073M

NEW

OCCUR=2

NODE=M073M;LINKAGE=AB

NODE=M073M;LINKAGE=MO

NODE=M073M;LINKAGE=NS

NODE=M073M;LINKAGE=ST

NODE=M073M;LINKAGE=SE

 $\psi(4415)$ WIDTH

NODE=M073W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
110 ± 22 OUR AVERAGE			
Error includes scale factor of 2.3. [72 ± 19 MeV OUR 2023 AVERAGE]			
122.5 ± 7.5 ± 8.1	ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+} D_s^{*-}$
71.5 ± 19.0	⁶ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
118 ± 32	⁷ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
77 ± 20	⁸ PAKHLOVA	08A BELL	$10.6 e^+e^- \rightarrow D^0 D^- \pi^+ \gamma$
119 ± 16	⁹ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
118 ± 35	¹⁰ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
66 ± 15	BRANDELIK	78C DASP	e^+e^-
33 ± 10	SIEGRIST	76 MRK1	e^+e^-
⁶ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.			
⁷ Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects.			
⁸ Systematic uncertainties not estimated.			
⁹ From a fit to Crystal Ball (OSTERHELD 86) data.			
¹⁰ From a fit to BES (BAI 02C) data.			

NODE=M073W

NEW

OCCUR=2

NODE=M073W;LINKAGE=AB

NODE=M073W;LINKAGE=MO

NODE=M073W;LINKAGE=NS

NODE=M073W;LINKAGE=ST

NODE=M073W;LINKAGE=SE

 $\psi(4415)$ DECAY MODES

NODE=M073215;NODE=M073

NODE=M073

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective $\sqrt{s}$ near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in $\sqrt{s}$ or absence thereof. See mode listing(s) for details and references.

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad D\bar{D}$	seen	
$\Gamma_2 \quad D^0\bar{D}^0$	seen	
$\Gamma_3 \quad D^+D^-$	seen	
$\Gamma_4 \quad D^*\bar{D} + \text{c.c.}$	seen	
$\Gamma_5 \quad D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	

DESIG=7;OUR EVAL;→ UNCHECKED ←

DESIG=8

DESIG=9

DESIG=10;OUR EVAL;→ UNCHECKED ←

DESIG=11

Γ_6	$D^*(2010)^+ D^- + \text{c.c.}$	seen			DESIG=12
Γ_7	$D^* \bar{D}^*$	seen			DESIG=13; OUR EVAL; → UNCHECKED ←
Γ_8	$D^*(2007)^0 \bar{D}^*(2007)^0 + \text{c.c.}$	seen			DESIG=14
Γ_9	$D^*(2010)^+ D^*(2010)^- + \text{c.c.}$	seen			DESIG=15
Γ_{10}	$D^0 D^- \pi^+ (\text{excl. } D^*(2010)^+ D^- + \text{c.c.})$	< 2.3	%	90%	DESIG=4
Γ_{11}	$D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.}$	(10 ± 4)	%		DESIG=5
Γ_{12}	$D^0 D^{*-} \pi^+ + \text{c.c.}$	< 19	%	90%	DESIG=6
Γ_{13}	$D_1(2420) \bar{D} + \text{c.c.}$	possibly seen			DESIG=25
Γ_{14}	$D_s^+ D_s^-$	not seen			DESIG=16
Γ_{15}	$\omega \chi_{c2}$	possibly seen			DESIG=20
Γ_{16}	$D_s^{*+} D_s^- + \text{c.c.}$	seen			DESIG=17
Γ_{17}	$D_s^{*+} D_s^{*-}$	seen			DESIG=18
Γ_{18}	$\psi_2(3823) \pi^+ \pi^-$	possibly seen			DESIG=21
Γ_{19}	$\psi(3770) \pi^+ \pi^-$	possibly seen			DESIG=24
Γ_{20}	$J/\psi \eta$	< 6	$\times 10^{-3}$	90%	DESIG=19
Γ_{21}	$\chi_{c1} \gamma$	< 8	$\times 10^{-4}$	90%	DESIG=22
Γ_{22}	$\chi_{c2} \gamma$	< 4	$\times 10^{-3}$	90%	DESIG=23
Γ_{23}	$\Lambda \bar{\Lambda}$	< 3.1	$\times 10^{-6}$	90%	DESIG=27
Γ_{24}	$\Xi^- \bar{\Xi}^+$	< 4	$\times 10^{-5}$	90%	DESIG=30
Γ_{25}	$p K^- \bar{\Lambda} + \text{c.c.}$	< 6	$\times 10^{-6}$	90%	DESIG=31
Γ_{26}	$\omega \pi^0$	not seen			DESIG=28
Γ_{27}	$\omega \eta$	not seen			DESIG=29
Γ_{28}	$e^+ e^-$	(5.3 ± 1.2)	$\times 10^{-6}$		DESIG=1
Γ_{29}	$\mu^+ \mu^-$	(1.1 ± 0.5)	$\times 10^{-5}$		DESIG=26

 $\psi(4415)$ PARTIAL WIDTHS

NODE=M073220

 $\Gamma(e^+ e^-)$ **Γ_{28}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.58 ± 0.07 OUR ESTIMATE			
0.35 ± 0.12	¹¹ ABLIKIM	08D BES2	$e^+ e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.4 to 0.8	¹² MO	10 RVUE	$e^+ e^- \rightarrow \text{hadrons}$
0.72 ± 0.11	¹³ SETH	05A RVUE	$e^+ e^- \rightarrow \text{hadrons}$
0.64 ± 0.23	¹⁴ SETH	05A RVUE	$e^+ e^- \rightarrow \text{hadrons}$
0.49 ± 0.13	BRANDELIK	78C DASP	$e^+ e^-$
0.44 ± 0.14	SIEGRIST	76 MRK1	$e^+ e^-$

NODE=M073W1
 NODE=M073W1
 → UNCHECKED ←

OCCUR=2

¹¹ Reanalysis of data presented in BAI 02C. From a global fit over the center-of-mass energy region 3.7–5.0 GeV covering the $\psi(3770)$, $\psi(4040)$, $\psi(4160)$, and $\psi(4415)$ resonances. Phase angle fixed in the fit to $\delta = (234 \pm 88)^\circ$.

NODE=M073W1; LINKAGE=AB

¹² Reanalysis of data presented in BAI 00 and BAI 02C. From a global fit over the center-of-mass energy 3.8–4.8 GeV covering the $\psi(4040)$, $\psi(4160)$ and $\psi(4415)$ resonances and including interference effects. Four sets of solutions are obtained with the same fit quality, mass and total width, but with different $e^+ e^-$ partial widths. We quote only the range of values.

NODE=M073W1; LINKAGE=MO

¹³ From a fit to Crystal Ball (OSTERHELD 86) data.

NODE=M073W1; LINKAGE=ST

¹⁴ From a fit to BES (BAI 02C) data.

NODE=M073W1; LINKAGE=SE

 $\Gamma(\mu^+ \mu^-)$ **Γ_{29}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.25 ± 0.28 ± 0.35	^{15,16} ABLIKIM	20AG BES3	$e^+ e^- \rightarrow \mu^+ \mu^-$
¹⁵ From a fit to the $e^+ e^- \rightarrow \mu^+ \mu^-$ cross section between 3.8 and 4.6 GeV to the coherent sum of four resonant amplitudes assuming $\Gamma(\mu^+ \mu^-) = \Gamma(e^+ e^-)$.			
¹⁶ From solution 1 of 8 with equal fit quality. Other solutions range from $1.24 \pm 0.28 \pm 0.35$ to $1.27 \pm 0.41 \pm 0.36$ keV.			

NODE=M073W2
 NODE=M073W2

NODE=M073W2; LINKAGE=A

NODE=M073W2; LINKAGE=B

 $\psi(4415) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M073230

 $\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ **$\Gamma_{20} \Gamma_{28} / \Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 3.6	90	WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

NODE=M073G01
 NODE=M073G01

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{28}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	17 HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

¹⁷ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M073G02
NODE=M073G02

NODE=M073G02;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_{28}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	18 HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

¹⁸ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M073G03
NODE=M073G03

NODE=M073G03;LINKAGE=A

$$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_{28}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.8 × 10⁻³	90	19 ABLIKIM	21AS BES3	$e^+e^- \rightarrow \psi(4415)$

¹⁹ From a measurement of the $e^+e^- \rightarrow \Lambda\bar{\Lambda}$ cross section between 3.5 and 4.6 GeV.

NODE=M073R16
NODE=M073R16

NODE=M073R16;LINKAGE=A

$$\Gamma(\Xi^-\Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{24}\Gamma_{28}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.0217	90	20 ABLIKIM	23BK BES3	$e^+e^- \rightarrow \psi(4415)$

²⁰ From a fit to $e^+e^- \rightarrow \Xi^-\Xi^+$ cross sections.

NODE=M073R19
NODE=M073R19

NODE=M073R19;LINKAGE=A

$$\Gamma(pK^-\bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{25}\Gamma_{28}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<3.4 × 10⁻³	90	21 ABLIKIM	23BL BES3	$e^+e^- \rightarrow \psi(4415)$

²¹ From a fit to $e^+e^- \rightarrow pK^-\bar{\Lambda} + \text{c.c.}$ cross sections.

NODE=M073R21
NODE=M073R21

NODE=M073R21;LINKAGE=A

$$\psi(4415) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M073235

$$\Gamma(D^0D^{*-}\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma \times \Gamma_{28}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99 × 10⁻⁶	90	22 PAKHLOVA	09 BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+$

²² Using 4421 ± 4 MeV for the mass of $\psi(4415)$.

NODE=M073R01
NODE=M073R01

NODE=M073R01;LINKAGE=PA

$\psi(4415)$ BRANCHING RATIOS

NODE=M073225

$$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^0\bar{D}^0\gamma$

NODE=M073R04
NODE=M073R04

$$\Gamma(D^+D^-)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	08 BELL	$e^+e^- \rightarrow D^+D^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^+D^-\gamma$

NODE=M073R05
NODE=M073R05

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$

NODE=M073R06
NODE=M073R06

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	23 ZHUKOVA	18 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

seen AUBERT 09M BABR $e^+e^- \rightarrow D^{*+}D^-\gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

²³ Supersedes PAKHLOVA 07.

NODE=M073R07
NODE=M073R07

NODE=M073R07;LINKAGE=A

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*) \quad \Gamma_1/\Gamma_7$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.14 ± 0.12 ± 0.03	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M073R02
NODE=M073R02

$$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$$

$$\Gamma_4/\Gamma_7$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.17±0.25±0.03	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

NODE=M073R03
NODE=M073R03

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_8/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

NODE=M073R08
NODE=M073R08

$$\Gamma(D^*(2010)^+D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_9/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	24 ZHUKOVA	18 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M073R09
NODE=M073R09

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	PAKHLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

²⁴Supersedes PAKHLOVA 07.

NODE=M073R09;LINKAGE=A

$$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{11}/\Gamma$$

VALUE (units 10 ⁻²)	DOCUMENT ID	TECN	COMMENT
10.5±2.4±3.8	²⁵ PAKHLOVA	08A BELL	10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$

²⁵ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R3
NODE=M073R3

NODE=M073R3;LINKAGE=PA

$$\Gamma(D^0D^-\pi^+ (\text{excl. } D^*(2010)^+D^- + \text{c.c.})/\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})$$

$$\Gamma_{10}/\Gamma_{11}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	²⁶ PAKHLOVA	08A BELL	10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$

²⁶ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R4
NODE=M073R4

NODE=M073R4;LINKAGE=PA

$$\Gamma(D_1(2420)\bar{D} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{13}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	²⁷ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$

²⁷ Evidence for $e^+e^- \rightarrow D_1(2420)\bar{D} + \text{c.c.}$ between $\sqrt{s} = 4.3$ and 4.6 GeV, not necessarily resonant.

NODE=M073R15
NODE=M073R15

NODE=M073R15;LINKAGE=A

$$\Gamma(D_s^+D_s^-)/\Gamma_{\text{total}}$$

$$\Gamma_{14}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^+D_s^-\gamma$
not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^+D_s^-\gamma$

NODE=M073R10
NODE=M073R10

$$\Gamma(\omega\chi_{c2})/\Gamma_{\text{total}}$$

$$\Gamma_{15}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ABLIKIM	16A BES3	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

NODE=M073R00
NODE=M073R00

$$\Gamma(D_s^{*+}D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^{*+}D_s^-\gamma$
seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+}D_s^-\gamma$

NODE=M073R11
NODE=M073R11

$$\Gamma(D_s^{*+}D_s^{*-})/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	[not seen OUR 2023 BEST LIMIT]		

seen	ABLIKIM	23BH BES3	$e^+e^- \rightarrow D_s^{*+}D_s^{*-}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	PAKHLOVA	11 BELL	$e^+e^- \rightarrow D_s^{*+}D_s^{*-}\gamma$

not seen	DEL-AMO-SA...10N	BABR	$e^+e^- \rightarrow D_s^{*+}D_s^{*-}\gamma$

NODE=M073R12
NODE=M073R12

$$\Gamma(\psi_2(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	19	²⁸ ABLIKIM	15S BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$

²⁸ From a fit of $e^+e^- \rightarrow \pi^+\pi^-\psi_2(3823)$, $\psi_2(3823) \rightarrow \chi_{c1}\gamma$ cross sections taken at $\sqrt{s}$ values of 4.23, 4.26, 4.36, 4.42, and 4.60 GeV to the $\psi(4415)$ line shape.

NODE=M073R13
NODE=M073R13

NODE=M073R13;LINKAGE=A

$\Gamma(\psi(3770)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	²⁹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^- D\bar{D}$

²⁹ Observe $e^+e^- \rightarrow \pi^+\pi^-\psi(3770)$ at $\sqrt{s} = 4.26, 4.36$, and 4.42 GeV but cannot establish if continuum or resonant.

NODE=M073R14
NODE=M073R14

NODE=M073R14;LINKAGE=A

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\pi^0$

NODE=M073R17
NODE=M073R17

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	22K BES3	$e^+e^- \rightarrow \omega\eta$

NODE=M073R18
NODE=M073R18

 $\psi(4415)$ REFERENCES

ABLIKIM	23BH	PRL 131 151903	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AS	PR D104 L091104	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20AG	PR D102 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	16A	PR D93 011102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15S	PRL 115 011803	M. Ablikim <i>et al.</i>	(BESIII Collab.)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	11	PR D83 011101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10N	PR D82 052004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
MO	10	PR D82 077501	X.H. Mo, C.Z. Yuan, P. Wang	(BHEP)
AUBERT	09M	PR D79 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	08D	PL B660 315	M. Ablikim <i>et al.</i>	(BES Collab.)
PAKHLOVA	08	PR D77 011103	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	08A	PRL 100 062001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
SETH	05A	PR D72 017501	K.K. Seth	
BAI	02C	PRL 88 101802	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	00	PRL 84 594	J.Z. Bai <i>et al.</i>	(BES Collab.)
OSTERHELD	86	SLAC-PUB-4160	A. Osterheld <i>et al.</i>	(SLAC Crystal Ball Collab.)
BRANDELIK	78C	PL 76B 361	R. Brandelik <i>et al.</i>	(DASP Collab.)
SIEGRIST	76	PRL 36 700	J.L. Siegrist <i>et al.</i>	(LBL, SLAC)

NODE=M073

REFID=62433
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$\chi_{c0}(4500)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

OMITTED FROM SUMMARY TABLE
was $X(4500)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M234

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c0}K^+$, $\chi_{c0} \rightarrow J/\psi\phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi\phi K^+$ with a significance (accounting for systematic uncertainties) of 6.1σ .

 $\chi_{c0}(4500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4474 \pm 3 \pm 3$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$4506 \pm 11^{+12}_{-15}$	4289	^{2,3} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 20σ .

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 6.1σ .

³ Superseded by AAIJ 21E.

NODE=M234M

NODE=M234M

NODE=M234M;LINKAGE=B
NODE=M234M;LINKAGE=A
NODE=M234M;LINKAGE=C

 $\chi_{c0}(4500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$77 \pm 6^{+10}_{-8}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$92 \pm 21^{+21}_{-20}$	4289	^{2,3} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$

NODE=M234W

NODE=M234W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 20σ .
² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .
³ Superseded by AAIJ 21E.

NODE=M234W;LINKAGE=B
NODE=M234W;LINKAGE=A
NODE=M234W;LINKAGE=C

$\chi_{c0}(4500)$ DECAY MODES

NODE=M234215;NODE=M234

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen

DESIG=1

$\chi_{c0}(4500)$ BRANCHING RATIOS

NODE=M234220

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	4289	^{2,3} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 20σ . ² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ . ³ Superseded by AAIJ 21E.					

NODE=M234R01
NODE=M234R01

NODE=M234R01;LINKAGE=B
NODE=M234R01;LINKAGE=A
NODE=M234R01;LINKAGE=C

$\chi_{c0}(4500)$ REFERENCES

NODE=M234

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=61150
REFID=57657
REFID=57636

$X(4630)$

$I^G(J^{PC}) = 0^+(?^?+)$

NODE=M262

OMITTED FROM SUMMARY TABLE

This state shows properties different from a conventional $q\bar{q}$ state. A candidate for an exotic structure. See the review on "Heavy Non- $q\bar{q}$ Mesons."

Seen by AAIJ 21E in $B^+ \rightarrow X(4630) K^+$ with $X(4630) \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 5.5σ . The $J^P = 1^-$ assignment is favored over 2^- with a significance of 3σ and other assignments are disfavored by more than 5σ .

NODE=M262

$X(4630)$ MASS

NODE=M262M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4626 \pm 16^{+18}_{-110}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.5σ .				

NODE=M262M

NODE=M262M

NODE=M262M;LINKAGE=A

$X(4630)$ WIDTH

NODE=M262W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
170^{+140}_{-80} OUR AVERAGE	[174^{+140}_{-80} MeV OUR 2023 AVERAGE]			
$174 \pm 27^{+134}_{-73}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.5σ .				

NODE=M262W

NEW

NODE=M262W;LINKAGE=A

X(4630) DECAY MODES

NODE=M262215;NODE=M262

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \phi$	seen

DESIG=1

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$	

NODE=M262R01
NODE=M262R01¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.5 σ .

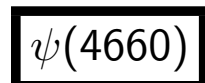
NODE=M262R01;LINKAGE=A

X(4630) REFERENCESAAIJ 21E PRL 127 082001 R. Aaij *et al.* (LHCb Collab.)

NODE=M262

REFID=61150

NODE=M189



$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as Y(4660); was X(4660)

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M189

Seen in radiative return from e^+e^- collisions at $\sqrt{s} = 9.54\text{--}10.58$ GeV by WANG 07D. Also obtained in a combined fit of WANG 07D, AUBERT 07S, and LEES 14F. See also the review on "Spectroscopy of mesons containing two heavy quarks."

 $\psi(4660)$ MASS

NODE=M189M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4641 ± 10 OUR AVERAGE		Error includes scale factor of 2.7. See the ideogram below.		
[4630 ± 6 MeV OUR 2023 AVERAGE		Scale factor = 1.4]		

NODE=M189M
NEW

4708 $^{+17}_{-15} \pm 21$		¹ ABLIKIM	23BI	BES3	$e^+e^- \rightarrow K^+K^-J/\psi$
4701.8 $\pm 10.9 \pm 2.7$		² ABLIKIM	23H	BES3	$e^+e^- \rightarrow \phi \chi_{c2}$
4675.3 $\pm 29.5 \pm 3.5$		³ ABLIKIM	23X	BES3	$e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$
4651.0 $\pm 37.8 \pm 2.1$		⁴ ABLIKIM	21AJ	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
4619.8 $^{+8.9}_{-8.0} \pm 2.3$	66	⁵ JIA	20	BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s2}^{*-}(2573)^-$
4625.9 $^{+6.2}_{-6.0} \pm 0.4$	89	⁶ JIA	19A	BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s1}(2536)^-$
4652 $\pm 10 \pm 11$	279	⁷ WANG	15A	BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$
4669 $\pm 21 \pm 3$	37	⁸ LEES	14F	BABR	$10.58 e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$
4634 $^{+8}_{-7} \pm 5$	142	⁹ PAKHLOVA	08B	BELL	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4647.9 $\pm 8.6 \pm 0.8$		¹⁰ ABLIKIM	22R	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
4652.5 $\pm 3.4 \pm 1.1$		¹¹ DAI	17	RVUE	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
4645.2 $\pm 9.5 \pm 6.0$		¹² ZHANG	17B	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
4646.4 $\pm 9.7 \pm 4.8$		¹³ ZHANG	17C	RVUE	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$ or $\psi(2S)$
4661 $^{+9}_{-8} \pm 6$	44	¹⁴ LIU	08H	RVUE	$10.58 e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$
4664 $\pm 11 \pm 5$	44	WANG	07D	BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$

¹ Seen as a peak in the c.m. energy dependence of the $e^+e^- \rightarrow K^+K^-J/\psi$ cross section using 5.85 fb⁻¹ of data at c.m. energies 4.61–4.95 GeV. Statistical significance is over 5 σ .

NODE=M189M;LINKAGE=M

² Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.

NODE=M189M;LINKAGE=J

³ From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4209.6 $\pm$ 7.5 (81.6 $\pm$ 19.9) MeV and 4469.1 $\pm$ 26.4 (246.3 $\pm$ 37.9) MeV.

NODE=M189M;LINKAGE=L

⁴ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.

NODE=M189M;LINKAGE=G

⁵ Using $D_{s2}^*(2573)^- \rightarrow \bar{D}^0 K^-$ decays.

⁶ From a fit of a Breit-Wigner convolved with a Gaussian.

⁷ From a two-resonance fit. Supersedes WANG 07D.

⁸ From a two-resonance fit.

⁹ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.

¹⁰ From a fit to the $e^+ e^- \rightarrow \pi^+ \pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.

¹¹ The pole parameters are extracted from the speed plot.

¹² From a three-resonance fit.

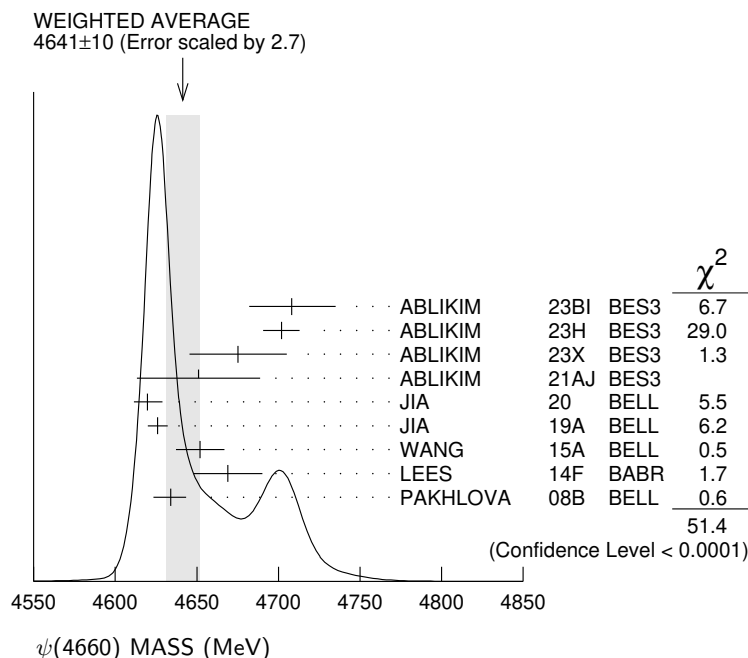
¹³ From a combined fit of BELLE, BABAR and BES3 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ and $e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$ data.

¹⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189M;LINKAGE=F
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NODE=M189M;LINKAGE=A
NODE=M189M;LINKAGE=LE
NODE=M189M;LINKAGE=PA
NODE=M189M;LINKAGE=I

NODE=M189M;LINKAGE=C
NODE=M189M;LINKAGE=D
NODE=M189M;LINKAGE=B

NODE=M189M;LINKAGE=LI



$\psi(4660)$ WIDTH

NODE=M189W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

73 $^{+13}_{-11}$ OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below.

NODE=M189W

[72 $^{+14}_{-12}$ MeV OUR 2023 AVERAGE Scale factor = 1.7]

NEW

126 $^{+27}_{-23} \pm 30$	1	ABLIKIM	23BI	BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$
30.5±22.3±14.6	2	ABLIKIM	23H	BES3	$e^+ e^- \rightarrow \phi \chi_{c2}$
218.3±72.9± 9.3	3	ABLIKIM	23X	BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$
155.4±24.8± 0.8	4	ABLIKIM	21AJ	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
47.0 $^{+31.3}_{-14.8} \pm 4.6$	66	5	JIA	20 BELL	$e^+ e^- \rightarrow \gamma D_s^+ D_{s2}^*(2573)^-$
49.8 $^{+13.9}_{-11.5} \pm 4.0$	89	6	JIA	19A BELL	$e^+ e^- \rightarrow \gamma D_s^+ D_{s1}(2536)^-$
68 ±11 ± 5	279	7	WANG	15A BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
104 ±48 ±10	37	8	LEES	14F BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
92 $^{+40}_{-24} \pm 10$	142	9	PAKHLOVA	08B BELL	$e^+ e^- \rightarrow \Lambda_c^+ \Lambda_c^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

33.1±18.6± 4.1	10	ABLIKIM	22R	BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
62.6± 5.6± 4.3	11	DAI	17	RVUE	$e^+ e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
113.8±18.1± 3.4	12	ZHANG	17B	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
103.5±15.6± 4.0	13	ZHANG	17C	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
42 $^{+17}_{-12} \pm 6$	44	14	LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
48 ±15 ± 3	44	WANG	07D	BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

- ¹ Seen as a peak in the c.m. energy dependence of the $e^+e^- \rightarrow K^+K^- J/\psi$ cross section using 5.85 fb^{-1} of data at c.m. energies 4.61–4.95 GeV. Statistical significance is over 5σ .
- ² Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.
- ³ From a cross-section measurement of $e^+e^- \rightarrow D^{*0}D^{*-}\pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. The two other resonances have masses (widths) 4209.6 ± 7.5 (81.6 ± 19.9) MeV and 4469.1 ± 26.4 (246.3 ± 37.9) MeV.
- ⁴ From a three-resonance fit to the Born cross section in the range $\sqrt{s} = 4.008\text{--}4.698$ GeV.
- ⁵ Using $D_{s2}^*(2573)^- \rightarrow \bar{D}^0 K^-$ decays.
- ⁶ From a fit of a Breit-Wigner convolved with a Gaussian.
- ⁷ From a two-resonance fit. Supersedes WANG 07D.
- ⁸ From a two-resonance fit.
- ⁹ The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+\Lambda_c^-$ states are not necessarily the same.
- ¹⁰ From a fit to the $e^+e^- \rightarrow \pi^+\pi^-\psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances. The data is also consistent with a single peak with mass $4417.5 \pm 26.2 \pm 3.5$ MeV and width $245 \pm 48 \pm 13$ MeV.
- ¹¹ The pole parameters are extracted from the speed plot.
- ¹² From a three-resonance fit.
- ¹³ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.
- ¹⁴ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

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NODE=M189W;LINKAGE=J

NODE=M189W;LINKAGE=K

NODE=M189W;LINKAGE=H

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NODE=M189W;LINKAGE=A

NODE=M189W;LINKAGE=LE

NODE=M189W;LINKAGE=B

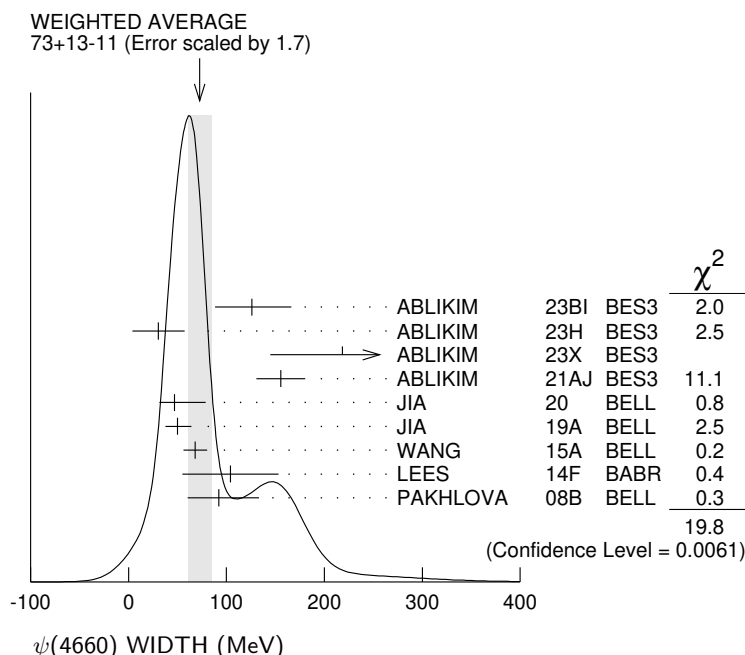
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NODE=M189W;LINKAGE=D

NODE=M189W;LINKAGE=E

NODE=M189W;LINKAGE=C

NODE=M189W;LINKAGE=LI

 **$\psi(4660)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	not seen
Γ_2 $\psi(2S)\pi^+\pi^-$	seen
Γ_3 $J/\psi\eta$	not seen
Γ_4 $D^0D^{*-}\pi^+$	not seen
Γ_5 $D^{*0}D^{*-}\pi^+$	seen
Γ_6 $\psi_2(3823)\pi^+\pi^-$	seen
Γ_7 $\chi_{c1}\gamma$	not seen
Γ_8 $\chi_{c1}\phi$	not seen
Γ_9 $\chi_{c2}\gamma$	not seen
Γ_{10} $\chi_{c2}\phi$	not seen
Γ_{11} $\Lambda_c^+\Lambda_c^-$	seen
Γ_{12} $D_s^+D_{s1}^-(2536)^-$	seen
Γ_{13} $D_s^+D_{s2}^*(2573)^-$	seen
Γ_{14} $\omega\pi^0$	not seen
Γ_{15} $\omega\eta$	not seen
Γ_{16} $\Xi^-\Xi^+$	not seen
Γ_{17} $pK^-\bar{\Lambda} + \text{c.c.}$	not seen

NODE=M189215;NODE=M189

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=4;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=15;OUR EVAL;→ UNCHECKED ←
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 DESIG=6;OUR EVAL;→ UNCHECKED ←
 DESIG=13;OUR EVAL;→ UNCHECKED ←
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 DESIG=9;OUR EVAL;→ UNCHECKED ←
 DESIG=11
 DESIG=12
 DESIG=16;OUR EVAL;→ UNCHECKED ←
 DESIG=17;OUR EVAL;→ UNCHECKED ←

$\psi(4660) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M189230

 $\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1 / \Gamma$ NODE=M189G1
NODE=M189G1

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.7±3.8		¹ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
11.2±3.2		² ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
4.7±4.2		³ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
11.3±3.3		⁴ ABLIKIM	21AJ BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
2.0±0.3±0.2	279	⁵ WANG	15A BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
8.1±1.1±1.0	279	⁶ WANG	15A BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
2.7±1.3±0.5	37	⁷ LEES	14F BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
7.5±1.7±0.7	37	⁸ LEES	14F BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
2.2 ^{+0.7} _{-0.6}	44	⁹ LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
5.9±1.6	44	¹⁰ LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
3.0±0.9±0.3	44	⁷ WANG	07D BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
7.6±1.8±0.8	44	⁸ WANG	07D BELL	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ Solution I of four equivalent solutions in a fit using three interfering resonances.² Solution II of four equivalent solutions in a fit using three interfering resonances.³ Solution III of four equivalent solutions in a fit using three interfering resonances.⁴ Solution IV of four equivalent solutions in a fit using three interfering resonances.⁵ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.⁶ Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.⁷ Solution I of two equivalent solutions in a fit using two interfering resonances.⁸ Solution II of two equivalent solutions in a fit using two interfering resonances.⁹ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.¹⁰ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M189G1;LINKAGE=C

NODE=M189G1;LINKAGE=D

NODE=M189G1;LINKAGE=E

NODE=M189G1;LINKAGE=F

NODE=M189G1;LINKAGE=A

NODE=M189G1;LINKAGE=B

NODE=M189G1;LINKAGE=WA

NODE=M189G1;LINKAGE=WN

NODE=M189G1;LINKAGE=LI

NODE=M189G1;LINKAGE=LU

 $\Gamma(J/\psi\eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_3 \Gamma_1 / \Gamma$ NODE=M189G01
NODE=M189G01

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.94	90	WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

 $\Gamma(D^{*0} D^{*-} \pi^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_5 \Gamma_1 / \Gamma$ NODE=M189R10
NODE=M189R10

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
19 to 2005	¹ ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$

¹ From a cross-section measurement of $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. Depending on solutions I – VIII with same fit qualities.

NODE=M189R10;LINKAGE=A

 $\Gamma(\chi_{c1} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_1 / \Gamma$ NODE=M189G02
NODE=M189G02

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.45	90	¹ HAN	15 BELL	10.58 $e^+ e^- \rightarrow \chi_{c1} \gamma$

¹ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M189G02;LINKAGE=A

 $\Gamma(\chi_{c1} \phi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_1 / \Gamma$ NODE=M189R08
NODE=M189R08

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.04	90	¹ ABLIKIM	23H BES3	$e^+ e^- \rightarrow \phi \chi_{c1}$

¹ Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term.

NODE=M189R08;LINKAGE=A

 $\Gamma(\chi_{c2} \gamma) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_1 / \Gamma$ NODE=M189G03
NODE=M189G03

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹ HAN	15 BELL	10.58 $e^+ e^- \rightarrow \chi_{c2} \gamma$

¹ Using $B(\eta \rightarrow \gamma \gamma) = (39.41 \pm 0.21)\%$.

NODE=M189G03;LINKAGE=A

$$\Gamma(\chi_{c2}\phi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.13±0.13

¹ ABLIKIM 23H BES3 $e^+e^- \rightarrow \phi\chi_{c2}$

¹ Fit model parameterized as the coherent sum of a Breit-Wigner resonance and a continuum amplitude term. Constructive solution of the interference. Destructive solution gives 0.66 ± 0.41 eV.

 $\Gamma_{10}\Gamma_1/\Gamma$

NODE=M189R09
NODE=M189R09

NODE=M189R09;LINKAGE=A

$$\Gamma(D_s^+ D_{s1}(2536)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

$14.3^{+2.8}_{-2.6} \pm 1.5$ 89 ¹ JIA 19A BELL $e^+e^- \rightarrow \gamma D_s^+ D_{s1}(2536)^-$

¹ Assuming $B(D_{s1}(2536)^- \rightarrow \bar{D}^{*0} K^-) = 1$.

 $\Gamma_{12}\Gamma_1/\Gamma$

NODE=M189R00
NODE=M189R00

NODE=M189R00;LINKAGE=A

$$\Gamma(D_s^+ D_{s2}^*(2573)^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

$14.7^{+5.9}_{-4.5} \pm 3.6$ 66 ¹ JIA 20 BELL $e^+e^- \rightarrow \gamma D_s^+ D_{s2}^*(2573)^-$

¹ Assuming $B(D_{s2}^*(2573)^- \rightarrow \bar{D}^0 K^-) = 1$.

 $\Gamma_{13}\Gamma_1/\Gamma$

NODE=M189R04
NODE=M189R04

NODE=M189R04;LINKAGE=A

$$\Gamma(\Xi^- \Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.0199 90 ¹ ABLIKIM 23BK BES3 $e^+e^- \rightarrow \psi(4660)$

¹ From a fit to $e^+e^- \rightarrow \Xi^- \Xi^+$ cross sections.

 $\Gamma_{16}\Gamma_1/\Gamma$

NODE=M189R11
NODE=M189R11

NODE=M189R11;LINKAGE=A

$$\Gamma(pK^- \bar{\Lambda} + \text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

$<2.8 \times 10^{-3}$ 90 ¹ ABLIKIM 23BL BES3 $e^+e^- \rightarrow \psi(4660)$

¹ From a fit to $e^+e^- \rightarrow pK^- \bar{\Lambda} + \text{c.c.}$ cross sections.

 $\Gamma_{17}\Gamma_1/\Gamma$

NODE=M189R13
NODE=M189R13

NODE=M189R13;LINKAGE=A

$$\psi(4660) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$$

NODE=M189235

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<0.37 \times 10^{-6}$ 90 ¹ PAKHLOVA 09 BELL $e^+e^- \rightarrow D^0 D^{*-} \pi^+$

¹ Using $4664 \pm 11 \pm 5$ MeV for the mass of $\psi(4660)$.

 $\Gamma_4/\Gamma \times \Gamma_1/\Gamma$

NODE=M189R02
NODE=M189R02

NODE=M189R02;LINKAGE=PA

$$\Gamma(\Lambda_c^+ \Lambda_c^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

$0.68^{+0.16+0.29}_{-0.15-0.30}$ 142 ¹ PAKHLOVA 08B BELL $e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$

¹ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.

 $\Gamma_{11}/\Gamma \times \Gamma_1/\Gamma$

NODE=M189R03
NODE=M189R03

NODE=M189R03;LINKAGE=A

$\psi(4660)$ BRANCHING RATIOS

NODE=M189225

$$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S) \pi^+ \pi^-)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<10 90 PAKHLOVA 09 BELL $e^+e^- \rightarrow D^0 D^{*-} \pi^+$

 Γ_4/Γ_2

NODE=M189R01
NODE=M189R01

$$\Gamma(\psi_2(3823) \pi^+ \pi^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen ¹ ABLIKIM 22R BES3 $e^+e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$

¹ From a fit to the $e^+e^- \rightarrow \pi^+ \pi^- \psi(3823)$ cross section between 4.23 and 4.70 GeV with two coherent Breit-Wigner resonances.

 Γ_6/Γ

NODE=M189R05
NODE=M189R05

NODE=M189R05;LINKAGE=A

$$\Gamma(\omega \pi^0)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ABLIKIM 22K BES3 $e^+e^- \rightarrow \omega \pi^0$

 Γ_{14}/Γ

NODE=M189R06
NODE=M189R06

$$\Gamma(\omega \eta)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

not seen ABLIKIM 22K BES3 $e^+e^- \rightarrow \omega \eta$

 Γ_{15}/Γ

NODE=M189R07
NODE=M189R07

ψ(4660) REFERENCES

ABLIKIM	23BI	PRL 131 211902	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BK	JHEP 2311 228	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BL	JHEP 2312 027	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23H	JHEP 2301 132	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22K	JHEP 2207 064	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22R	PRL 129 102003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AJ	PR D104 052012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
JIA	20	PR D101 091101	S. Jia <i>et al.</i>	(BELLE Collab.)
JIA	19A	PR D100 111103	S. Jia <i>et al.</i>	(BELLE Collab.)
DAI	17	PR D96 116001	L.-Y. Dai, J. Haidenbauer, U.-G. Meissner	(JULI+)
ZHANG	17B	PR D96 054008	J. Zhang, J. Zhang	
ZHANG	17C	EPJ C77 727	J. Zhang, L. Yuan	
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)
LEES	14F	PR D89 111103	J.P. Lees <i>et al.</i>	(BABAR Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
PAKHLOVA	09	PR D80 091101	G. Pakhlova <i>et al.</i>	(BELLE Collab.)
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan	
PAKHLOVA	08B	PRL 101 172001	C. Pakhlova <i>et al.</i>	(BELLE Collab.)
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M189

REFID=62434
REFID=62437
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REFID=62050
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REFID=51724
REFID=51959

χ_{c1}(4685)

$I^G(J^{PC}) = 0^+(1^{++})$

OMITTED FROM SUMMARY TABLE

This state shows properties different from a conventional *q* $\bar{q}$ state. A candidate for an exotic structure. See the review on "Heavy Non-*q* $\bar{q}$ Mesons."

NODE=M261

Seen by AAIJ 21E in *B*⁺ → χ_{c1}(4685) *K*⁺ with χ_{c1}(4685) → *J/ψφ* using an amplitude analysis of *B*⁺ → *J/ψφK*⁺ with a significance (accounting for systematic uncertainties) of 15 σ. The *J*^{*P*} = 1⁺ assignment is favored with high significance.

χ_{c1}(4685) MASS

NODE=M261M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4684 ± 7 ⁺¹³ ₋₁₆	24k	¹ AAIJ	21E LHCb	<i>B</i> ⁺ → <i>J/ψφK</i> ⁺

NODE=M261M

¹ From an amplitude analysis of the decay *B*⁺ → *J/ψφK*⁺ with a significance of 15 σ.

NODE=M261M;LINKAGE=A

χ_{c1}(4685) WIDTH

NODE=M261W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
130 ± 40 OUR AVERAGE	[126 ± 40 MeV OUR 2023 AVERAGE]			
126 ± 15 ⁺³⁷ ₋₄₁	24k	¹ AAIJ	21E LHCb	<i>B</i> ⁺ → <i>J/ψφK</i> ⁺

NODE=M261W
NEW

¹ From an amplitude analysis of the decay *B*⁺ → *J/ψφK*⁺ with a significance of 15 σ.

NODE=M261W;LINKAGE=A

χ_{c1}(4685) DECAY MODES

NODE=M261215;NODE=M261

Mode	Fraction (Γ _{<i>i</i>} /Γ)
Γ ₁ <i>J/ψφ</i>	seen

DESIG=1

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi\phi K^+$	

NODE=M261R01
NODE=M261R01

¹ From an amplitude analysis of the decay *B*⁺ → *J/ψφK*⁺ with a significance of 15 σ.

NODE=M261R01;LINKAGE=A

χ_{c1}(4685) REFERENCES

NODE=M261

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP

REFID=61150

NODE=M235

$\chi_{c0}(4700)$

$I^G(J^{PC}) = 0^+(0^{++})$

OMITTED FROM SUMMARY TABLE
was $X(4700)$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M235

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c0} K^+$, $\chi_{c0} \rightarrow J/\psi \phi$ using an am-
plitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting
for systematic uncertainties) of 5.6σ .

$\chi_{c0}(4700)$ MASS

NODE=M235M

NODE=M235M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$4694 \pm 4^{+16}_{-3}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4741 \pm 6 \pm 6$	175	² AAIJ	21C LHCb	$B^0_s \rightarrow J/\psi \phi \pi^+ \pi^-$
$4704 \pm 10^{+14}_{-24}$	4289	^{3,4} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 17σ .				
² From a 1D fit to the $J/\psi \phi$ mass distribution with a significance of 5.3σ . The identi- fication of this structure as the $\chi_{c0}(4700)$ needs confirmation.				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M235M;LINKAGE=C
NODE=M235M;LINKAGE=B

NODE=M235M;LINKAGE=A
NODE=M235M;LINKAGE=D

$\chi_{c0}(4700)$ WIDTH

NODE=M235W

NODE=M235W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$87 \pm 8^{+16}_{-6}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$53 \pm 15 \pm 11$	175	² AAIJ	21C LHCb	$B^0_s \rightarrow J/\psi \phi \pi^+ \pi^-$
$120 \pm 31^{+42}_{-33}$	4289	^{3,4} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 17σ .				
² From a 1D fit to the $J/\psi \phi$ mass distribution with a significance of 5.3σ . The identi- fication of this structure as the $\chi_{c0}(4700)$ needs confirmation.				
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .				
⁴ Superseded by AAIJ 21E.				

NODE=M235W;LINKAGE=C
NODE=M235W;LINKAGE=B

NODE=M235W;LINKAGE=A
NODE=M235W;LINKAGE=D

$\chi_{c0}(4700)$ DECAY MODES

NODE=M235215;NODE=M235

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad J/\psi \phi$	seen

DESIG=1

$\chi_{c0}(4700)$ BRANCHING RATIOS

NODE=M235220

NODE=M235R01
NODE=M235R01

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	175	² AAIJ	21C LHCb	$B^0_s \rightarrow J/\psi \phi \pi^+ \pi^-$	
seen	4289	^{3,4} AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	
¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 17σ .					
² From a 1D fit to the $J/\psi \phi$ mass distribution with a significance of 5.3σ . The identi- fication of this structure as the $\chi_{c0}(4700)$ needs confirmation.					
³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .					
⁴ Superseded by AAIJ 21E.					

NODE=M235R01;LINKAGE=C
NODE=M235R01;LINKAGE=B

NODE=M235R01;LINKAGE=A
NODE=M235R01;LINKAGE=D

$\chi_{c0}(4700)$ REFERENCES

NODE=M235

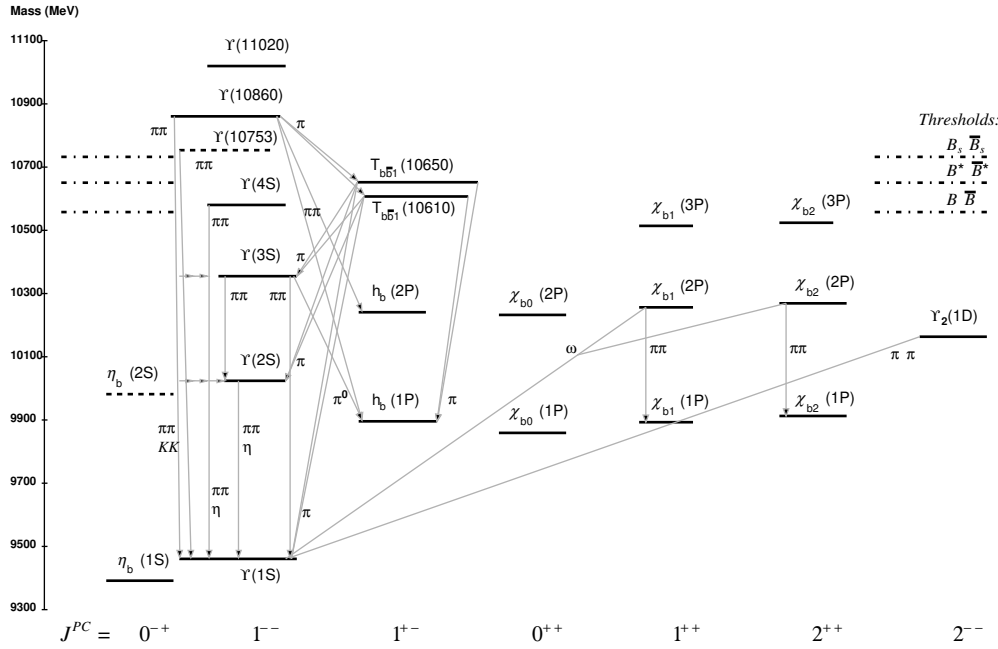
AAIJ	21C	JHEP 2102 024	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61124
AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=61150
AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP	REFID=57657
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57636

$b\bar{b}$ MESONS (including possibly non- $q\bar{q}$ states)

NODE=MXXX030

NODE=M849

Updated March 2024.



The level scheme of meson states containing a minimal quark content of $b\bar{b}$ and having $S = C = B = 0$. The name of a state is determined by its quantum numbers $I^G J^{PC}$ (see the review “Naming Scheme for Hadrons”). States included in the Summary Tables are shown with solid lines; those requiring confirmation are shown with dotted lines. The arrows indicate the most dominant hadronic transitions. Single photon transitions, including $\Upsilon(nS) \rightarrow \gamma \eta_b(mS)$, $\Upsilon(nS) \rightarrow \gamma \chi_{bJ}(mP)$, and $\chi_{bJ}(nP) \rightarrow \gamma \Upsilon(mS)$, are omitted for clarity. For orientation, the location of the thresholds related to a pair of ground state open bottom mesons is indicated in the figure. Decays to open flavour final states are not shown in the figure. $\Upsilon(10753)$ ω -transitions to $\chi_{b1}(1P)$ and $\chi_{b2}(1P)$ have also been reported.

NODE=M849

WIDTH DETERMINATIONS OF THE Υ STATES

As is the case for the $J/\psi(1S)$ and $\psi(2S)$, the full widths of the $b\bar{b}$ states $\Upsilon(1S)$, $\Upsilon(2S)$, and $\Upsilon(3S)$ are not directly measurable, since they are much narrower than the energy resolution of the e^+e^- storage rings where these states are

produced. The common indirect method to determine Γ starts from

$$\Gamma = \Gamma_{\ell\ell}/B_{\ell\ell} , \quad (2.1)$$

where $\Gamma_{\ell\ell}$ is one leptonic partial width and $B_{\ell\ell}$ is the corresponding branching fraction ($\ell = e, \mu$, or τ). One then assumes e - μ - τ universality and uses

$$\Gamma_{\ell\ell} = \Gamma_{ee}$$

$$B_{\ell\ell} = \text{average of } B_{ee}, B_{\mu\mu}, \text{ and } B_{\tau\tau} . \quad (2.2)$$

The electronic partial width Γ_{ee} is also not directly measurable at e^+e^- storage rings, only in the combination $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$, where Γ_{had} is the hadronic partial width and

$$\Gamma_{\text{had}} + 3\Gamma_{ee} = \Gamma . \quad (2.3)$$

This combination is obtained experimentally from the energy-integrated hadronic cross section

$$\begin{aligned} & \int_{\text{resonance}} \sigma(e^+e^- \rightarrow \Upsilon \rightarrow \text{hadrons}) dE \\ &= \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma} C_r = \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}^{(0)}\Gamma_{\text{had}}}{\Gamma} C_r^{(0)} , \end{aligned} \quad (2.4)$$

where M is the Υ mass, and C_r and $C_r^{(0)}$ are radiative correction factors. C_r is used for obtaining Γ_{ee} as defined in Eq. (2.1), and contains corrections from all orders of QED for describing $(b\bar{b}) \rightarrow e^+e^-$. The lowest order QED value $\Gamma_{ee}^{(0)}$, relevant for comparison with potential-model calculations, is defined by the lowest order QED graph (Born term) alone, and is about 7% lower than Γ_{ee} .

The Listings give experimental results on B_{ee} , $B_{\mu\mu}$, $B_{\tau\tau}$, and $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$. The entries of the last quantity have been re-evaluated consistently using the correction procedure of KURA EV 85 [1]. The partial width Γ_{ee} is obtained from the average values for $\Gamma_{ee}\Gamma_{\text{had}}/\Gamma$ and $B_{\ell\ell}$ using

$$\Gamma_{ee} = \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma(1 - 3B_{\ell\ell})} . \quad (2.5)$$

The total width Γ is then obtained from Eq. (2.1). We do not list Γ_{ee} and Γ values of individual experiments. The Γ_{ee} values in the Meson Summary Table are also those defined in Eq. (2.1).

References

1. E.A. Kuraev, V.S. Fadin, Sov. J. Nucl. Phys. **41**, 466 (1985).

$$\eta_b(1S)$$

$$J^{PC} = 0^{+}(0^{-+})$$

Quantum numbers shown are quark-model predictions. Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$.

NODE=M171

NODE=M171

NODE=M171M

NODE=M171M

$\eta_b(1S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9398.7 ± 2.0 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.				
9394.8 ^{+2.7} _{-3.1} ± 2.7	29k	FULSOM	18 BELL	$\Upsilon(2S) \rightarrow \gamma X$
9400.7 ± 1.7 ± 1.6	33.1k	TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma \eta + \text{hadrons}$
9402.4 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma \pi^+ \pi^- + \text{hadrons}$
9391.8 ± 6.6 ± 2.0	2.3k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
9394.2 ^{+4.8} _{-4.9} ± 2.0	13k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
9388.9 ^{+3.1} _{-2.3} ± 2.7	19k	² AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9393.2 ± 3.4 ± 2.3	10	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$
9300 ± 20 ± 20		HEISTER	02D ALEP	181–209 e^+e^-

¹ With floating width. Not independent of the corresponding mass difference measurement.

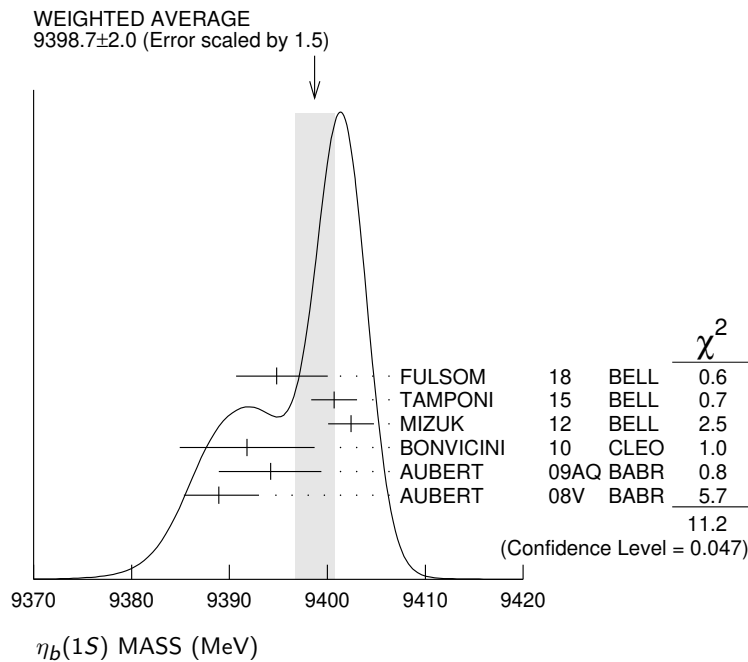
² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.

³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M;LINKAGE=MI

NODE=M171M;LINKAGE=AU

NODE=M171M;LINKAGE=DO



$m_{\Upsilon(1S)} - m_{\eta_b}$

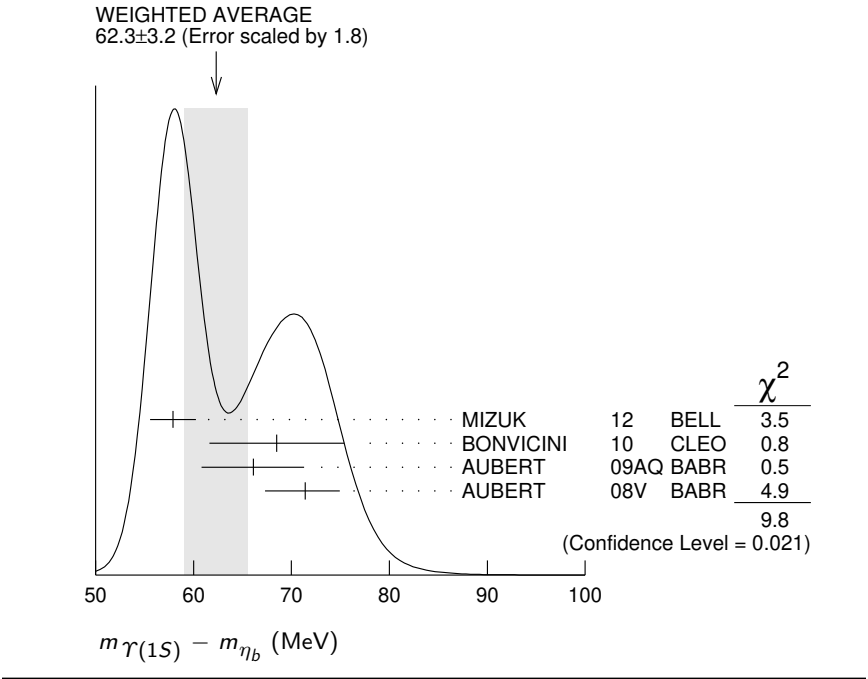
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
62.3 ± 3.2 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.				
57.9 ± 1.5 ± 1.8	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma \pi^+ \pi^- + \text{hadrons}$
68.5 ± 6.6 ± 2.0	2.3 ± 0.5k	² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
66.1 ^{+4.8} _{-4.9} ± 2.0	13 ± 5k	² AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$
71.4 ^{+2.3} _{-3.1} ± 2.7	19 ± 3k	² AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
67.1 ± 3.4 ± 2.3	10 ⁺⁵ ₋₄	^{2,3} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M171M2

NODE=M171M2

¹With floating width. Not independent of the corresponding mass measurement.
²Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.
³Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M171M2;LINKAGE=MI
NODE=M171M2;LINKAGE=AU
NODE=M171M2;LINKAGE=DO



γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M171DM
NODE=M171DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$920.6^{+2.8}_{-3.2}$ OUR AVERAGE				
$918.6 \pm 6.0 \pm 1.9$	$2.3 \pm 0.5k$	¹ BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
$921.2^{+2.1}_{-2.8} \pm 2.4$	$19 \pm 3k$	¹ AUBERT	08v BABR	$\Upsilon(3S) \rightarrow \gamma X$

¹Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171DM;LINKAGE=BO

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M171U2S
NODE=M171U2S

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$609.3^{+4.6}_{-4.5} \pm 1.9$	$13 \pm 5k$	¹ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$

¹Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171U2S;LINKAGE=AU

$\eta_b(1S)$ WIDTH

NODE=M171W
NODE=M171W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10^{+5}_{-4} OUR AVERAGE				
$8^{+6}_{-5} \pm 5$	$33.1k$	¹ TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
$10.8^{+4.0+4.5}_{-3.7-2.0}$	$34k$	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

¹With floating mass.

NODE=M171W;LINKAGE=MI

$\eta_b(1S)$ DECAY MODES

NODE=M171225;NODE=M171

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 hadrons	seen	
Γ_2 $3h^+3h^-$	not seen	
Γ_3 $2h^+2h^-$	not seen	
Γ_4 $4h^+4h^-$	not seen	
Γ_5 $\gamma\gamma$	not seen	
Γ_6 $\mu^+\mu^-$	$<9 \times 10^{-3}$	90%
Γ_7 $\tau^+\tau^-$	$<8\%$	90%

DESIG=7

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=5

DESIG=6

 $\eta_b(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M171230

$\Gamma(3h^+3h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_5/\Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G1
NODE=M171G1

• • • We do not use the following data for averages, fits, limits, etc. • • •

<470	95	ABDALLAH	06	DLPH	161–209 e^+e^-
<132	95	HEISTER	02D	ALEP	181–209 e^+e^-

$\Gamma(2h^+2h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_5/\Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G2
NODE=M171G2

• • • We do not use the following data for averages, fits, limits, etc. • • •

<190	95	ABDALLAH	06	DLPH	161–209 e^+e^-
<48	95	HEISTER	02D	ALEP	181–209 e^+e^-

$\Gamma(4h^+4h^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_4\Gamma_5/\Gamma$			
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M171G3
NODE=M171G3

• • • We do not use the following data for averages, fits, limits, etc. • • •

<660	95	ABDALLAH	06	DLPH	161–209 e^+e^-

 $\eta_b(1S)$ BRANCHING RATIOS

NODE=M171235

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$					Γ_1/Γ
<u>VALUE</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	34k	MIZUK	12	BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons

NODE=M171R03
NODE=M171R03

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	

NODE=M171R01
NODE=M171R01

$<9 \times 10^{-3}$ 90 ^{1} AUBERT 09Z BABR $e^+e^- \rightarrow \Upsilon(2S, 3S) \rightarrow \gamma\eta_b$

^{1} Obtained using $B(\Upsilon(2S) \rightarrow \gamma\eta_b) = (4.2^{+1.1}_{-1.0} \pm 0.9) \times 10^{-4}$ and $B(\Upsilon(3S) \rightarrow \gamma\eta_b) = (4.8 \pm 0.5 \pm 0.6) \times 10^{-4}$. This limit is equivalent to $B(\eta_b \rightarrow \mu^+\mu^-) = (-0.25 \pm 0.51 \pm 0.33)\%$ measurement.

NODE=M171R01;LINKAGE=AU

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
$<8 \times 10^{-2}$	90	AUBERT	09P	BABR	$e^+e^- \rightarrow \gamma\tau^+\tau^-$

NODE=M171R02
NODE=M171R02 $\eta_b(1S)$ REFERENCES

NODE=M171

FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABDALLAH	06	PL B634 340	J.M. Abdallah <i>et al.</i>	(DELPHI Collab.)
HEISTER	02D	PL B530 56	A. Heister <i>et al.</i>	(ALEPH Collab.)

REFID=59535
REFID=56996
REFID=54288
REFID=54718
REFID=53231
REFID=53106
REFID=53062
REFID=52930
REFID=52262
REFID=51042
REFID=48577

$\Upsilon(1S)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M049

 $\Upsilon(1S)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.40±0.09±0.04	¹ SHAMOV	23	RVUE $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.11±0.11±0.07	² SHAMOV	23	RVUE $e^+e^- \rightarrow$ hadrons
9460.51±0.09±0.05	^{3,4} ARTAMONOV	00	MD1 $e^+e^- \rightarrow$ hadrons
9460.60±0.09±0.05	^{5,6} BARU	92B	MD1 $e^+e^- \rightarrow$ hadrons
9460.59±0.12	BARU	86	MD1 $e^+e^- \rightarrow$ hadrons
9460.6 ±0.4	^{6,7} ARTAMONOV	84	MD1 $e^+e^- \rightarrow$ hadrons
9459.97±0.11±0.07	⁸ MACKAY	84	CUSB $e^+e^- \rightarrow$ hadrons

¹ Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.

² Obtained by reanalysing CUSB data (MACKAY 84), but not authored by the CUSB collaboration.

³ Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).

⁴ Superseded by SHAMOV 23.

⁵ Supersedes BARU 86.

⁶ Superseded by ARTAMONOV 00.

⁷ Value includes data of ARTAMONOV 82.

⁸ Reanalysed by SHAMOV 23.

NODE=M049M

NODE=M049M

OCCUR=2

NODE=M049M;LINKAGE=D

NODE=M049M;LINKAGE=E

NODE=M049M;LINKAGE=AR

NODE=M049M;LINKAGE=B

NODE=M049M;LINKAGE=A

NODE=M049M;LINKAGE=RZ

NODE=M049M;LINKAGE=G

NODE=M049M;LINKAGE=C

 $\Upsilon(1S)$ WIDTH

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M049W

NODE=M049W

→ UNCHECKED ←

 $\Upsilon(1S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\tau^+\tau^-$	(2.60 ±0.10) %	
Γ_2 e^+e^-	(2.39 ±0.08) %	
Γ_3 $\mu^+\mu^-$	(2.48 ±0.04) %	

DESIG=3

DESIG=2

DESIG=1

Hadronic decays

Γ_4 ggg	(81.7 ±0.7) %		
Γ_5 γgg	(2.2 ±0.6) %		
Γ_6 $\eta'(958)$ anything	(2.94 ±0.24) %		
Γ_7 $J/\psi(1S)$ anything	(5.4 ±0.4) × 10 ⁻⁴	S=1.4	
Γ_8 $J/\psi(1S)\eta_c$	< 2.2	× 10 ⁻⁶	CL=90%
Γ_9 $J/\psi(1S)\chi_{c0}$	< 3.4	× 10 ⁻⁶	CL=90%
Γ_{10} $J/\psi(1S)\chi_{c1}$	(3.9 ±1.2) × 10 ⁻⁶		
Γ_{11} $J/\psi(1S)\chi_{c2}$	< 1.4	× 10 ⁻⁶	CL=90%
Γ_{12} $J/\psi(1S)\eta_c(2S)$	< 2.2	× 10 ⁻⁶	CL=90%
Γ_{13} $J/\psi(1S)X(3940)$	< 5.4	× 10 ⁻⁶	CL=90%
Γ_{14} $J/\psi(1S)X(4160)$	< 5.4	× 10 ⁻⁶	CL=90%
Γ_{15} $X(4350)$ anything, $X \rightarrow J/\psi(1S)\phi$	< 8.1	× 10 ⁻⁶	CL=90%
Γ_{16} $T_{c\bar{c}1}(3900)^\pm$ anything, $T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm$	< 1.3	× 10 ⁻⁵	CL=90%
Γ_{17} $T_{c\bar{c}1}(4200)^\pm$ anything, $Z_c \rightarrow J/\psi(1S)\pi^\pm$	< 6.0	× 10 ⁻⁵	CL=90%
Γ_{18} $T_{c\bar{c}1}(4430)^\pm$ anything, $T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm$	< 4.9	× 10 ⁻⁵	CL=90%
Γ_{19} $X_{cs}^\pm$ anything, $X \rightarrow J/\psi K^\pm$	< 5.7	× 10 ⁻⁶	CL=90%
Γ_{20} $\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)\pi^+\pi^-$	< 3.8	× 10 ⁻⁵	CL=90%
Γ_{21} $\psi(4230)$ anything, $\psi \rightarrow J/\psi(1S)K^+K^-$	< 7.5	× 10 ⁻⁶	CL=90%

NODE=M049;CLUMP=A

DESIG=117

DESIG=118

DESIG=73

DESIG=12

DESIG=146

DESIG=147

DESIG=148

DESIG=149

DESIG=150

DESIG=151

DESIG=152

DESIG=167

DESIG=168

DESIG=169

DESIG=170

DESIG=173

DESIG=161

DESIG=165

Г22	$\chi_{c1}(4140)$ anything, $\chi_{c1} \rightarrow J/\psi(1S)\phi$	< 5.2	$\times 10^{-6}$	CL=90%	DESIG=166
Г23	χ_{c0} anything	< 4	$\times 10^{-3}$	CL=90%	DESIG=5
Г24	χ_{c1} anything	(1.90 ± 0.35)	$\times 10^{-4}$		DESIG=6
Г25	$\chi_{c1}(1P)X_{tetra}$	< 3.78	$\times 10^{-5}$	CL=90%	DESIG=175
Г26	χ_{c2} anything	(2.8 ± 0.8)	$\times 10^{-4}$		DESIG=7
Г27	$\psi(2S)$ anything	(1.23 ± 0.20)	$\times 10^{-4}$		DESIG=8
Г28	$\psi(2S)\eta_c$	< 3.6	$\times 10^{-6}$	CL=90%	DESIG=153
Г29	$\psi(2S)\chi_{c0}$	< 6.5	$\times 10^{-6}$	CL=90%	DESIG=154
Г30	$\psi(2S)\chi_{c1}$	< 4.5	$\times 10^{-6}$	CL=90%	DESIG=155
Г31	$\psi(2S)\chi_{c2}$	< 2.1	$\times 10^{-6}$	CL=90%	DESIG=156
Г32	$\psi(2S)\eta_c(2S)$	< 3.2	$\times 10^{-6}$	CL=90%	DESIG=157
Г33	$\psi(2S)X(3940)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=158
Г34	$\psi(2S)X(4160)$	< 2.9	$\times 10^{-6}$	CL=90%	DESIG=159
Г35	$\psi(4230)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 7.9	$\times 10^{-5}$	CL=90%	DESIG=162
Г36	$\psi(4360)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 5.2	$\times 10^{-5}$	CL=90%	DESIG=163
Г37	$\psi(4660)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	< 2.2	$\times 10^{-5}$	CL=90%	DESIG=164
Г38	$T_{c\bar{c}}(4050)^\pm$ anything, $X \rightarrow \psi(2S)\pi^\pm$	< 8.8	$\times 10^{-5}$	CL=90%	DESIG=171
Г39	$T_{c\bar{c}1}(4430)^\pm$ anything, $T_{c\bar{c}1} \rightarrow \psi(2S)\pi^\pm$	< 6.7	$\times 10^{-5}$	CL=90%	DESIG=172
Г40	$\chi_{c1}(3872)$ anything	< 2.7	$\times 10^{-4}$	CL=90%	DESIG=194
Г41	$T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-$	< 2.23	$\times 10^{-5}$	CL=90%	DESIG=178
Г42	$T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp$	< 8.1	$\times 10^{-6}$	CL=90%	DESIG=179
Г43	$T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-$	< 1.8	$\times 10^{-6}$	CL=90%	DESIG=180
Г44	$T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-$	< 1.58	$\times 10^{-5}$	CL=90%	DESIG=181
Г45	$T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-$	< 2.66	$\times 10^{-5}$	CL=90%	DESIG=182
Г46	$T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp$	< 4.42	$\times 10^{-5}$	CL=90%	DESIG=183
Г47	$T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-$	< 2.03	$\times 10^{-5}$	CL=90%	DESIG=184
Г48	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp$	< 2.33	$\times 10^{-5}$	CL=90%	DESIG=186
Г49	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp$	< 4.55	$\times 10^{-5}$	CL=90%	DESIG=189
Г50	$\rho\pi$	< 3.68	$\times 10^{-6}$	CL=90%	DESIG=11
Г51	$\omega\pi^0$	< 3.90	$\times 10^{-6}$	CL=90%	DESIG=131
Г52	$\pi^+\pi^-$	< 5	$\times 10^{-4}$	CL=90%	DESIG=23
Г53	K^+K^-	< 5	$\times 10^{-4}$	CL=90%	DESIG=24
Г54	$p\bar{p}$	< 5	$\times 10^{-4}$	CL=90%	DESIG=25
Г55	$\pi^+\pi^-\pi^0$	(2.1 ± 0.8)	$\times 10^{-6}$		DESIG=72
Г56	ϕK^+K^-	(2.4 ± 0.5)	$\times 10^{-6}$		DESIG=136
Г57	$\omega\pi^+\pi^-$	(4.5 ± 1.0)	$\times 10^{-6}$		DESIG=137
Г58	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(4.4 ± 0.8)	$\times 10^{-6}$		DESIG=138
Г59	$\phi f'_2(1525)$	< 1.63	$\times 10^{-6}$	CL=90%	DESIG=139
Г60	$\omega f_2(1270)$	< 1.79	$\times 10^{-6}$	CL=90%	DESIG=140
Г61	$\rho(770) a_2(1320)$	< 2.24	$\times 10^{-6}$	CL=90%	DESIG=141
Г62	$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	(3.0 ± 0.8)	$\times 10^{-6}$		DESIG=142
Г63	$K_1(1270)^\pm K^\mp$	< 2.41	$\times 10^{-6}$	CL=90%	DESIG=143
Г64	$K_1(1400)^\pm K^\mp$	(1.0 ± 0.4)	$\times 10^{-6}$		DESIG=144
Г65	$b_1(1235)^\pm \pi^\mp$	< 1.25	$\times 10^{-6}$	CL=90%	DESIG=145
Г66	$\pi^+\pi^-\pi^0\pi^0$	(1.28 ± 0.30)	$\times 10^{-5}$		DESIG=132
Г67	$K_S^0 K^+ \pi^- + \text{c.c.}$	(1.6 ± 0.4)	$\times 10^{-6}$		DESIG=133
Г68	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(2.9 ± 0.9)	$\times 10^{-6}$		DESIG=134
Г69	$K^*(892)^- K^+ + \text{c.c.}$	< 1.11	$\times 10^{-6}$	CL=90%	DESIG=135
Г70	$f_1(1285)$ anything	(4.6 ± 3.1)	$\times 10^{-3}$		DESIG=174
Г71	$D^*(2010)^\pm$ anything	(2.52 ± 0.20)	%		DESIG=30
Г72	$f_1(1285)X_{tetra}$	< 6.24	$\times 10^{-5}$	CL=90%	DESIG=176
Г73	^2H anything	(2.85 ± 0.25)	$\times 10^{-5}$		DESIG=107
Г74	Sum of 100 exclusive modes	(1.200 ± 0.017)	%		DESIG=128

Radiative decays

NODE=M049;CLUMP=B

Г75	$\gamma\pi^+\pi^-$	(6.3 ±1.8)	$\times 10^{-5}$		DESIG=70
Г76	$\gamma\pi^0\pi^0$	(1.7 ±0.7)	$\times 10^{-5}$		DESIG=71
Г77	$\gamma\pi\pi$ (S-wave)	(4.6 ±0.7)	$\times 10^{-5}$		DESIG=190
Г78	$\gamma\pi^0\eta$	< 2.4	$\times 10^{-6}$	CL=90%	DESIG=111
Г79	$\gamma K^+ K^-$	[a] (1.14 ±0.13)	$\times 10^{-5}$		DESIG=102
Г80	$\gamma p\bar{p}$	[b] < 6	$\times 10^{-6}$	CL=90%	DESIG=103
Г81	$\gamma 2h^+ 2h^-$	(7.0 ±1.5)	$\times 10^{-4}$		DESIG=20
Г82	$\gamma 3h^+ 3h^-$	(5.4 ±2.0)	$\times 10^{-4}$		DESIG=21
Г83	$\gamma 4h^+ 4h^-$	(7.4 ±3.5)	$\times 10^{-4}$		DESIG=22
Г84	$\gamma\pi^+\pi^- K^+ K^-$	(2.9 ±0.9)	$\times 10^{-4}$		DESIG=14
Г85	$\gamma 2\pi^+ 2\pi^-$	(2.5 ±0.9)	$\times 10^{-4}$		DESIG=13
Г86	$\gamma 3\pi^+ 3\pi^-$	(2.5 ±1.2)	$\times 10^{-4}$		DESIG=17
Г87	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	(2.4 ±1.2)	$\times 10^{-4}$		DESIG=18
Г88	$\gamma\pi^+\pi^- p\bar{p}$	(1.5 ±0.6)	$\times 10^{-4}$		DESIG=15
Г89	$\gamma 2\pi^+ 2\pi^- p\bar{p}$	(4 ±6)	$\times 10^{-5}$		DESIG=19
Г90	$\gamma 2K^+ 2K^-$	(2.0 ±2.0)	$\times 10^{-5}$		DESIG=16
Г91	$\gamma\eta'(958)$	< 1.9	$\times 10^{-6}$	CL=90%	DESIG=55
Г92	$\gamma\eta$	< 1.0	$\times 10^{-6}$	CL=90%	DESIG=54
Г93	$\gamma f_0(980)$	< 3	$\times 10^{-5}$	CL=90%	DESIG=105
Г94	$\gamma f_2'(1525)$	(2.9 ±0.6)	$\times 10^{-5}$		DESIG=52
Г95	$\gamma f_2(1270)$	(1.01 ±0.06)	$\times 10^{-4}$		DESIG=51
Г96	$\gamma\eta(1405)$	< 8.2	$\times 10^{-5}$	CL=90%	DESIG=65
Г97	$\gamma f_0(1500)$	< 1.5	$\times 10^{-5}$	CL=90%	DESIG=108
Г98	$\gamma f_0(1500) \rightarrow \gamma K^+ K^-$	(1.0 ±0.4)	$\times 10^{-5}$		DESIG=192
Г99	$\gamma f_0(1710)$	< 2.6	$\times 10^{-4}$	CL=90%	DESIG=53
Г100	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	(1.01 ±0.32)	$\times 10^{-5}$		DESIG=112
Г101	$\gamma f_0(1710) \rightarrow \gamma\pi^+\pi^-$	(5.3 ±2.0)	$\times 10^{-6}$		DESIG=191
Г102	$\gamma f_0(1710) \rightarrow \gamma\pi^0\pi^0$	< 1.4	$\times 10^{-6}$	CL=90%	DESIG=109
Г103	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	< 1.8	$\times 10^{-6}$	CL=90%	DESIG=110
Г104	$\gamma f_4(2050)$	< 5.3	$\times 10^{-5}$	CL=90%	DESIG=104
Г105	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	< 2	$\times 10^{-4}$	CL=90%	DESIG=69
Г106	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	< 8	$\times 10^{-7}$	CL=90%	DESIG=60
Г107	$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	< 6	$\times 10^{-7}$	CL=90%	DESIG=61
Г108	$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	< 1.1	$\times 10^{-6}$	CL=90%	DESIG=62
Г109	$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	< 3	$\times 10^{-3}$	CL=90%	DESIG=68
Г110	$\gamma\eta_c(1S)$	< 2.9	$\times 10^{-5}$	CL=90%	DESIG=119
Г111	$\gamma\eta_c(2S)$	< 4	$\times 10^{-4}$	CL=90%	DESIG=193
Г112	$\gamma\chi_{c0}$	< 6.6	$\times 10^{-5}$	CL=90%	DESIG=120
Г113	$\gamma\chi_{c1}$	(4.7 $\begin{smallmatrix} +2.4 \\ -1.9 \end{smallmatrix}$)	$\times 10^{-5}$		DESIG=121
Г114	$\gamma\chi_{c2}$	< 7.6	$\times 10^{-6}$	CL=90%	DESIG=122
Г115	$\gamma\chi_{c1}(3872)$	< 5	$\times 10^{-5}$	CL=90%	DESIG=195
Г116	$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.8	$\times 10^{-6}$	CL=90%	DESIG=124
Г117	$\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi$	< 3.0	$\times 10^{-6}$	CL=90%	DESIG=125
Г118	$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 2.2	$\times 10^{-6}$	CL=90%	DESIG=126
Г119	$\gamma X\bar{X} (m_X < 3.1 \text{ GeV})$	[c] < 1	$\times 10^{-3}$	CL=90%	DESIG=67
Г120	$\gamma X\bar{X} (m_X < 4.5 \text{ GeV})$	[d] < 2.4	$\times 10^{-4}$	CL=90%	DESIG=127
Г121	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[e] < 1.78	$\times 10^{-4}$	CL=95%	DESIG=113
Г122	γA^0	[f]			DESIG=66
Г123	$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	[g] < 9	$\times 10^{-6}$	CL=90%	DESIG=114
Г124	$\gamma A^0 \rightarrow \gamma\tau^+\tau^-$	[a] < 1.30	$\times 10^{-4}$	CL=90%	DESIG=115
Г125	$\gamma A^0 \rightarrow \gamma g g$	[h] < 1	%	CL=90%	DESIG=129
Г126	$\gamma A^0 \rightarrow \gamma s\bar{s}$	[h] < 1	$\times 10^{-3}$	CL=90%	DESIG=130

Lepton Family number (LF) violating modes

NODE=M049;CLUMP=C

Г127	$e^\pm\mu^\mp$	LF	< 3.9	$\times 10^{-7}$	CL=90%	DESIG=196
Г128	$\mu^\pm\tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%	DESIG=116
Г129	$e^\pm\tau^\mp$	LF	< 2.7	$\times 10^{-6}$	CL=90%	DESIG=197
Г130	$\gamma e^\pm\mu^\mp$	LF	< 4.2	$\times 10^{-7}$	CL=90%	DESIG=198
Г131	$\gamma\mu^\pm\tau^\mp$	LF	< 6.1	$\times 10^{-6}$	CL=90%	DESIG=199
Г132	$\gamma e^\pm\tau^\mp$	LF	< 6.5	$\times 10^{-6}$	CL=90%	DESIG=200

Other decays

Γ_{133} invisible	$< 3.0 \times 10^{-4}$ CL=90%
Γ_{134} hadrons	(96 $\pm$ 4) %

NODE=M049;CLUMP=D
DESIG=106
DESIG=101

- [a] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV
 [b] $2 \text{ GeV} < m_{K^+K^-} < 3$ GeV
 [c] $X\bar{X}$ = vectors with $m < 3.1$ GeV
 [d] X and $\bar{X}$ = zero spin with $m < 4.5$ GeV
 [e] $1.5 \text{ GeV} < m_X < 5.0$ GeV
 [f] A^0 = scalar with $m < 8.0$ GeV
 [g] $201 \text{ MeV} < M(\mu^+\mu^-) < 3565$ MeV
 [h] $0.5 \text{ GeV} < m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

LINKAGE=E49

LINKAGE=G49

LINKAGE=B49

LINKAGE=F49

LINKAGE=C49

LINKAGE=A49

LINKAGE=D49

LINKAGE=I49

 $\Upsilon(1S) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M049218

$\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_2/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
31.2$\pm$1.6$\pm$1.7	KOBEL 92 CBAL $e^+e^- \rightarrow \mu^+\mu^-$

NODE=M049G1
NODE=M049G1

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{134}\Gamma_2/\Gamma$
VALUE (keV)	DOCUMENT ID TECN COMMENT
1.240$\pm$0.016 OUR AVERAGE	
1.252 $\pm$ 0.004 $\pm$ 0.019	¹ ROSNER 06 CLEO $9.5 e^+e^- \rightarrow \text{hadrons}$
1.187 $\pm$ 0.023 $\pm$ 0.031	¹ BARU 92B MD1 $e^+e^- \rightarrow \text{hadrons}$
1.23 $\pm$ 0.02 $\pm$ 0.05	¹ JAKUBOWSKI 88 CBAL $e^+e^- \rightarrow \text{hadrons}$
1.37 $\pm$ 0.06 $\pm$ 0.09	² GILES 84B CLEO $e^+e^- \rightarrow \text{hadrons}$
1.23 $\pm$ 0.08 $\pm$ 0.04	² ALBRECHT 82 DASP $e^+e^- \rightarrow \text{hadrons}$
1.13 $\pm$ 0.07 $\pm$ 0.11	² NICZYPORUK 82 LENA $e^+e^- \rightarrow \text{hadrons}$
1.09 $\pm$ 0.25	² BOCK 80 CNTR $e^+e^- \rightarrow \text{hadrons}$
1.35 $\pm$ 0.14	³ BERGER 79 PLUT $e^+e^- \rightarrow \text{hadrons}$

NODE=M049G2
NODE=M049G2

¹ Radiative corrections evaluated following KURAEV 85.² Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.³ Radiative corrections reevaluated by ALEXANDER 89 using $B(\mu\mu) = 0.026$.

NODE=M049G2;LINKAGE=B
NODE=M049G2;LINKAGE=R
NODE=M049G2;LINKAGE=P

 $\Upsilon(1S)$ PARTIAL WIDTHS

NODE=M049220

$\Gamma(e^+e^-)$	Γ_2
VALUE (keV)	DOCUMENT ID
1.340$\pm$0.018 OUR EVALUATION	

NODE=M049W2
NODE=M049W2
 $\rightarrow$ UNCHECKED $\leftarrow$

 $\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE (units 10^{-2}) EVTS	DOCUMENT ID TECN COMMENT
2.60$\pm$0.10 OUR AVERAGE	
2.53 $\pm$ 0.13 $\pm$ 0.04 60k	¹ BESSON 07 CLEO $e^+e^- \rightarrow \Upsilon(1S) \rightarrow \tau^+\tau^-$
2.61 $\pm$ 0.12 $^{+0.09}_{-0.13}$ 25k	CINABRO 94B CLE2 $e^+e^- \rightarrow \tau^+\tau^-$
2.7 $\pm$ 0.4 $\pm$ 0.2	² ALBRECHT 85C ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
3.4 $\pm$ 0.4 $\pm$ 0.4	GILES 83 CLEO $e^+e^- \rightarrow \tau^+\tau^-$

NODE=M049R3
NODE=M049R3

¹ BESSON 07 reports $[\Gamma(\Upsilon(1S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = 1.02 \pm 0.02 \pm 0.05$ which we multiply by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

NODE=M049R3;LINKAGE=BE

NODE=M049R3;LINKAGE=A

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE (units 10^{-2}) EVTS	DOCUMENT ID TECN COMMENT
2.39$\pm$0.08 OUR AVERAGE	
2.40 $\pm$ 0.01 $\pm$ 0.12 191k	PATRA 22 BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.29 $\pm$ 0.08 $\pm$ 0.11	ALEXANDER 98 CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.42 $\pm$ 0.14 $\pm$ 0.14 307	ALBRECHT 87 ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.8 $\pm$ 0.3 $\pm$ 0.2 826	BESSON 84 CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
5.1 $\pm$ 3.0	BERGER 80C PLUT $e^+e^- \rightarrow e^+e^-$

NODE=M049R2
NODE=M049R2

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_3/Γ

NODE=M049R1
NODE=M049R1

VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

2.48±0.04 OUR AVERAGE

2.46±0.01±0.11	246k	PATRA	22	BELL	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.49±0.02±0.07	345k	ADAMS	05	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
2.49±0.08±0.13		ALEXANDER	98	CLE2	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.12±0.20±0.10		¹ BARU	92	MD1	$e^+e^- \rightarrow \mu^+\mu^-$
2.31±0.12±0.10		¹ KOBEL	92	CBAL	$e^+e^- \rightarrow \mu^+\mu^-$
2.52±0.07±0.07		CHEN	89B	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
2.61±0.09±0.11		KAARSBERG	89	CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
2.30±0.25±0.13	86	ALBRECHT	87	ARG	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.9 ±0.3 ±0.2	864	BESSON	84	CLEO	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
2.7 ±0.3 ±0.3		ANDREWS	83	CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
3.2 ±1.3 ±0.3		ALBRECHT	82	DASP	$e^+e^- \rightarrow \mu^+\mu^-$
3.8 ±1.5 ±0.2		NICZYPORUK	82	LENA	$e^+e^- \rightarrow \mu^+\mu^-$
1.4 ^{+3.4} _{-1.4}		BOCK	80	CNTR	$e^+e^- \rightarrow \mu^+\mu^-$
2.2 ±2.0		BERGER	79	PLUT	$e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_1/Γ_3

NODE=M049R43
NODE=M049R43

VALUE EVTS

DOCUMENT ID TECN COMMENT

1.008±0.023 OUR AVERAGE

1.005±0.013±0.022	0.7M	¹ DEL-AMO-SA..10C	BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^- \Upsilon(1S)$
1.02 ±0.02 ±0.05	60k	BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(1S)$

¹ Allows any number of extra photons with total energy < 500 MeV.

NODE=M049R43;LINKAGE=DE

 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_4/Γ

NODE=M049R35
NODE=M049R35

VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

81.7±0.7

20M

¹ BESSON 06A CLEO $\Upsilon(1S) \rightarrow \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ from BESSON 06A and PDG 08 values of $B(\mu^+\mu^-) = (2.48 \pm 0.05)\%$ and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M049R35;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ Γ_5/Γ

NODE=M049R36
NODE=M049R36

VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

2.20±0.60

400k

¹ BESSON 06A CLEO $\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$

¹ Calculated using BESSON 06A values of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.70 \pm 0.01 \pm 0.13 \pm 0.24)\%$ and $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$ Γ_5/Γ_4

NODE=M049R37
NODE=M049R37

VALUE (units 10^{-2}) EVTS

DOCUMENT ID TECN COMMENT

2.70±0.01±0.27

20M

BESSON 06A CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

NODE=M049R73
NODE=M049R73

VALUE

DOCUMENT ID TECN COMMENT

0.0294±0.0024 OUR AVERAGE

0.030 ±0.002 ±0.002	AQUINES	06A	CLE3	$\Upsilon(1S) \rightarrow \eta' \text{ anything}$
0.028 ±0.004 ±0.002	ARTUSO	03	CLE2	$\Upsilon(1S) \rightarrow \eta' \text{ anything}$

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_7/Γ

NODE=M049R12
NODE=M049R12

VALUE (units 10^{-4}) CL% EVTS

DOCUMENT ID TECN COMMENT

5.4 ±0.4 OUR FIT Error includes scale factor of 1.4.

5.4 ±0.4 OUR AVERAGE Error includes scale factor of 1.5.

5.25±0.13±0.25	3k	SHEN	16	BELL	$e^+e^- \rightarrow J/\psi X$
6.4 ±0.4 ±0.6	730	BRIERE	04	CLEO	$e^+e^- \rightarrow J/\psi X$
11 ±4 ±2		¹ FULTON	89	CLEO	$e^+e^- \rightarrow \mu^+\mu^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	ALBRECHT	92J	ARG	$e^+e^- \rightarrow e^+e^-X,$ $\mu^+\mu^-X$
<17	90	MASCHMANN	90	CBAL	$e^+e^- \rightarrow \text{hadrons}$
<200	90	NICZYPORUK	83	LENA	

¹ Using $B((J/\psi) \rightarrow \mu^+\mu^-) = (6.9 \pm 0.9)\%$.

NODE=M049R12;LINKAGE=K

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R85
NODE=M049R85

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R86
NODE=M049R86

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10 ⁻⁶)	EVT5	DOCUMENT ID	TECN	COMMENT
3.90 ± 1.21 ± 0.23	20	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R87
NODE=M049R87

$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R88
NODE=M049R88

$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R89
NODE=M049R89

$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R90
NODE=M049R90

$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.4 × 10 ⁻⁶	90	YANG	14	BELL $e^+e^- \rightarrow J/\psi X$

NODE=M049R91
NODE=M049R91

$\Gamma(X(4350) \text{ anything}, X \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.1 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P05
NODE=M049P05

$\Gamma(T_{c\bar{c}1}(3900)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P06
NODE=M049P06

$\Gamma(T_{c\bar{c}1}(4200)^\pm \text{ anything}, Z_c \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<6.0 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P07
NODE=M049P07

$\Gamma(T_{c\bar{c}1}(4430)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.9 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

NODE=M049P08
NODE=M049P08

$\Gamma(X_{cs}^\pm \text{ anything}, X \rightarrow J/\psi K^\pm)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.7 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^- X$

NODE=M049P11
NODE=M049P11

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.8 × 10 ⁻⁵	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R99
NODE=M049R99

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.5 × 10 ⁻⁶	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P03
NODE=M049P03

$\Gamma(\chi_{c1}(4140) \text{ anything}, \chi_{c1} \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$
 Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-6}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$

NODE=M049P04
NODE=M049P04

 $\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$
 Γ_{23}/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7.4	90	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R25
NODE=M049R25

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$
 Γ_{24}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.90±0.35 OUR FIT				
1.90±0.43±0.14	215	JIA	17	BELL $\Upsilon(1S) \rightarrow \gamma J/\psi(1S)$

NODE=M049P13
NODE=M049P13

 $\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$
 Γ_{24}/Γ_7

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.35±0.07 OUR FIT				
0.35±0.08±0.06	52 ± 12	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R26
NODE=M049R26

 $\Gamma(\chi_{c1}(1P)\chi_{tetra})/\Gamma_{\text{total}}$
 Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<37.8 \times 10^{-6}$	90	¹ JIA	17A	BELL $e^+ e^- \rightarrow \text{hadrons}$

NODE=M049P15
NODE=M049P15

¹ For a tetraquark state χ_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of χ_{tetra} mass and width range from 4.4×10^{-6} to 37.8×10^{-6} .

NODE=M049P15;LINKAGE=A

 $\Gamma(\chi_{c2} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$
 Γ_{26}/Γ_7

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.52±0.12±0.09	47 ± 11	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi X$

NODE=M049R27
NODE=M049R27

 $\Gamma(\psi(2S) \text{ anything})/\Gamma_{\text{total}}$
 Γ_{27}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
1.23±0.17±0.11	215	SHEN	16	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049P12
NODE=M049P12

 $\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$
 Γ_{27}/Γ_7

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.41±0.11±0.08	42 ± 11	BRIERE	04	CLEO $e^+ e^- \rightarrow J/\psi \pi^+ \pi^- X$

NODE=M049R28
NODE=M049R28

 $\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$
 Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.6 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R92
NODE=M049R92

 $\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$
 Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.5 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R93
NODE=M049R93

 $\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$
 Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.5 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R94
NODE=M049R94

 $\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$
 Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R95
NODE=M049R95

 $\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$
 Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R96
NODE=M049R96

 $\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$
 Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R97
NODE=M049R97

 $\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$
 Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.9 \times 10^{-6}$	90	YANG	14	BELL $e^+ e^- \rightarrow \psi(2S) X$

NODE=M049R98
NODE=M049R98

$\Gamma(\psi(4230) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.9 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P00
NODE=M049P00

 $\Gamma(\psi(4360) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P01
NODE=M049P01

 $\Gamma(\psi(4660) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$
 Γ_{37}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.2 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

NODE=M049P02
NODE=M049P02

 $\Gamma(T_{c\bar{c}}(4050)^\pm \text{ anything}, X \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$
 Γ_{38}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.8 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P09
NODE=M049P09

 $\Gamma(T_{c\bar{c}1}(4430)^\pm \text{ anything}, T_{c\bar{c}1} \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$
 Γ_{39}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.7 \times 10^{-5}$	90	SHEN	16	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P10
NODE=M049P10

 $\Gamma(\chi_{c1}(3872) \text{ anything})/\Gamma_{\text{total}}$
 Γ_{40}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.7 \times 10^{-4}$ (CL = 90%)		[$<2.5 \times 10^{-4}$ (CL = 90%) OUR 2023 BEST LIMIT]		
$<2.7 \times 10^{-4}$	90	¹ SHEN	16	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^+\pi^- X$

NODE=M049P31
NODE=M049P31

¹ SHEN 16 reports $[\Gamma(\Upsilon(1S) \rightarrow \chi_{c1}(3872) \text{ anything})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))]$ $< 9.5 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 3.5 \times 10^{-2}$.

NODE=M049P31;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-)/\Gamma_{\text{total}}$
 Γ_{41}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<22.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P17
NODE=M049P17

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi\pi^\pm) = 1$.

NODE=M049P17;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp)/\Gamma_{\text{total}}$
 Γ_{42}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.1 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P18
NODE=M049P18

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi\pi^\pm) = 1 = B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm)$.

NODE=M049P18;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-)/\Gamma_{\text{total}}$
 Γ_{43}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.8 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi\pi^\pm X$

NODE=M049P19
NODE=M049P19

¹ Assuming $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm) = 1$

NODE=M049P19;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-)/\Gamma_{\text{total}}$
 Γ_{44}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<15.8 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P20
NODE=M049P20

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P20;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-)/\Gamma_{\text{total}}$
 Γ_{45}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<26.6 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P21
NODE=M049P21

¹ Assuming $B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P21;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp)/\Gamma_{\text{total}}$
 Γ_{46}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<44.2 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \chi_{c1}(1P)\pi^\pm X$

NODE=M049P22
NODE=M049P22

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1 = B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm)$

NODE=M049P22;LINKAGE=A

 $\Gamma(T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-)/\Gamma_{\text{total}}$
 Γ_{47}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<20.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P23
NODE=M049P23

¹ Assuming $B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M049P23;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4055)^{\pm} T_{c\bar{c}}(4055)^{\mp})/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<23.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^{\pm}X$

¹ Assuming $B(T_{c\bar{c}}(4055)^{\pm} \rightarrow \psi(2S)\pi^{\pm}) = 1$

NODE=M049P25
NODE=M049P25

NODE=M049P25;LINKAGE=A

 $\Gamma(T_{c\bar{c}}(4055)^{\pm} T_{c\bar{c}1}(4430)^{\mp})/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<45.5 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^{\pm}X$

¹ Assuming $B(T_{c\bar{c}}(4055)^{\pm} \rightarrow \psi(2S)\pi^{\pm}) = 1 = B(T_{c\bar{c}1}(4430)^{\pm} \rightarrow \psi(2S)\pi^{\pm})$

NODE=M049P26
NODE=M049P26

NODE=M049P26;LINKAGE=A

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.68	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^{+}\pi^{-}\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$<1 \times 10^3$	90	BLINOV	90	MD1 $\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2 \times 10^2$	90	FULTON	90B	$\Upsilon(1S) \rightarrow \rho^0\pi^0$
$<2.1 \times 10^3$	90	NICZYPORUK	83	LENA $\Upsilon(1S) \rightarrow \rho^0\pi^0$

NODE=M049R11
NODE=M049R11

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.90	90	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^{+}\pi^{-}\pi^0\pi^0$

NODE=M049R05
NODE=M049R05

 $\Gamma(\pi^{+}\pi^{-})/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow \pi^{+}\pi^{-}$

NODE=M049R57
NODE=M049R57

 $\Gamma(K^{+}K^{-})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	BARU	92	MD1 $\Upsilon(1S) \rightarrow K^{+}K^{-}$

NODE=M049R58
NODE=M049R58

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ BARU	96	MD1 $\Upsilon(1S) \rightarrow p\bar{p}$

¹ Supersedes BARU 92 in this node.

NODE=M049R59
NODE=M049R59

NODE=M049R59;LINKAGE=A

 $\Gamma(\pi^{+}\pi^{-}\pi^0)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$2.14 \pm 0.72 \pm 0.34$		26 ± 9	SHEN	13	BELL $\Upsilon(1S) \rightarrow \pi^{+}\pi^{-}\pi^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<18.4	90	ANASTASSOV 99	CLE2	$e^{+}e^{-} \rightarrow \text{hadrons}$

NODE=M049R72
NODE=M049R72

 $\Gamma(\phi K^{+}K^{-})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.36 \pm 0.37 \pm 0.29$	56	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^{+}K^{-})$

NODE=M049R75
NODE=M049R75

 $\Gamma(\omega\pi^{+}\pi^{-})/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.46 \pm 0.67 \pm 0.72$	64	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^{+}\pi^{-})\pi^0$

NODE=M049R76
NODE=M049R76

 $\Gamma(K^{*}(892)^0 K^{-}\pi^{+} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{58}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.42 \pm 0.50 \pm 0.58$	173	SHEN	12A	BELL $\Upsilon(1S) \rightarrow K^{+}K^{-}\pi^{+}\pi^{-}$

NODE=M049R77
NODE=M049R77

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(K^{+}K^{-})$

NODE=M049R78
NODE=M049R78

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.79	90	SHEN	12A	BELL $\Upsilon(1S) \rightarrow 2(\pi^{+}\pi^{-})\pi^0$

NODE=M049R79
NODE=M049R79

$$\Gamma(\rho(770)a_2(1320))/\Gamma_{\text{total}} \quad \Gamma_{61}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.24	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M049R80
NODE=M049R80

$$\Gamma(K^*(892)^0\bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{62}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.02 \pm 0.68 \pm 0.34$	42	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M049R81
NODE=M049R81

$$\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}} \quad \Gamma_{63}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.41	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M049R82
NODE=M049R82

$$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}} \quad \Gamma_{64}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.02 \pm 0.35 \pm 0.22$	24	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+K^-\pi^+\pi^-$

NODE=M049R83
NODE=M049R83

$$\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}} \quad \Gamma_{65}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.25	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+\pi^-)\pi^0$

NODE=M049R84
NODE=M049R84

$$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{66}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$12.8 \pm 2.0 \pm 2.3$	143 ± 22	SHEN	13 BELL	$\Upsilon(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M049R06
NODE=M049R06

$$\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{67}/\Gamma$$

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.59 \pm 0.33 \pm 0.18$	37 ± 8		SHEN	13 BELL	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R07
NODE=M049R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.4	90	¹ DOBBS	12A	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R07;LINKAGE=DO

$$\Gamma(K^*(892)^0\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{68}/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.92 \pm 0.85 \pm 0.37$	16 ± 5	SHEN	13 BELL	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R08
NODE=M049R08

$$\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{69}/\Gamma$$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.11	90	SHEN	13 BELL	$\Upsilon(1S) \rightarrow K_S^0 K^- \pi^+$

NODE=M049R09
NODE=M049R09

$$\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{70}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.6 \pm 2.8 \pm 1.3$	3.1k	JIA	17A BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049P14
NODE=M049P14

$$\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{71}/\Gamma$$

<u>VALUE (units 10^{-3})</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$25.2 \pm 1.3 \pm 1.5$	$\approx 2k$	¹ AUBERT	10C	BABR	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049R32
NODE=M049R32

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19	90	² ALBRECHT	92J ARG	$e^+e^- \rightarrow D^0\pi^\pm X$

¹ For $x_p > 0.1$.

² For $x_p > 0.2$.

NODE=M049R32;LINKAGE=AU

NODE=M049R32;LINKAGE=B

$$\Gamma(f_1(1285)X_{\text{tetra}})/\Gamma_{\text{total}} \quad \Gamma_{72}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<62.4 \times 10^{-6}$	90	¹ JIA	17A BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049P16
NODE=M049P16

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.6×10^{-6} to 62.4×10^{-6} .

NODE=M049P16;LINKAGE=A

$\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS
2.85 ± 0.25	OUR AVERAGE
$2.81 \pm 0.49^{+0.20}_{-0.24}$	
$2.86 \pm 0.19 \pm 0.21$	455

DOCUMENT ID

TECN

COMMENT

LEES

14G

BABR

 $e^+ e^- \rightarrow \overline{2H} X$

ASNER

07

CLEO

 $e^+ e^- \rightarrow \overline{2H} X$ Γ_{73}/Γ

NODE=M049R33
NODE=M049R33

OCCUR=2

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})
1.200 ± 0.017

1,2 DOBBS

12A

 $\Upsilon(1S) \rightarrow \text{hadrons}$ Γ_{74}/Γ

NODE=M049R02
NODE=M049R02

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R02;LINKAGE=DO

NODE=M049R02;LINKAGE=NC

 $\Gamma(ggg, \gamma g g \rightarrow \overline{d} \text{ anything})/\Gamma(ggg, \gamma g g \rightarrow \text{anything})$

VALUE (units 10^{-5})	EVTS
$3.36 \pm 0.23 \pm 0.25$	455

DOCUMENT ID

TECN

COMMENT

ASNER

07

CLEO

 $e^+ e^- \rightarrow \overline{d} X$

NODE=M049R34
NODE=M049R34

 $\Gamma(\gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})
$6.3 \pm 1.2 \pm 1.3$

¹ ANASTASSOV 99

CLE2

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{75}/Γ

NODE=M049R70
NODE=M049R70

¹ For $m_{\pi\pi} > 1$ GeV.

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})
$1.7 \pm 0.6 \pm 0.3$

¹ ANASTASSOV 99

CLE2

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{76}/Γ

NODE=M049R71
NODE=M049R71

¹ For $m_{\pi\pi} > 1$ GeV.

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma \pi \pi (\text{S-wave}))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})
$4.63 \pm 0.56 \pm 0.48$

DOCUMENT ID

TECN

COMMENT

LEES

18A

BABR

 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$ Γ_{77}/Γ

NODE=M049P27
NODE=M049P27

 $\Gamma(\gamma \pi^0 \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%
< 2.4	90

¹ BESSON

07A

CLEO

 $e^+ e^- \rightarrow \Upsilon(1S)$ Γ_{78}/Γ

NODE=M049R47
NODE=M049R47

¹ BESSON 07A obtained this limit for $0.7 < m_{\pi^0 \eta} < 3$ GeV.

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+ K^-)/\Gamma_{\text{total}}$ $(2 < m_{K^+ K^-} < 3 \text{ GeV})$

VALUE (units 10^{-5})	CL%
$1.14 \pm 0.08 \pm 0.10$	90

DOCUMENT ID

TECN

COMMENT

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$ Γ_{79}/Γ

NODE=M049R24

NODE=M049R24
NODE=M049R24

 $\Gamma(\gamma p \overline{p})/\Gamma_{\text{total}}$ $(2 < m_{p \overline{p}} < 3 \text{ GeV})$

VALUE (units 10^{-5})	CL%
< 0.6	90

DOCUMENT ID

TECN

COMMENT

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma p \overline{p}$ Γ_{80}/Γ

NODE=M049R29

NODE=M049R29
NODE=M049R29

 $\Gamma(\gamma 2h^+ 2h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
$7.0 \pm 1.1 \pm 1.0$	80 ± 12

DOCUMENT ID

TECN

COMMENT

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{81}/Γ

NODE=M049R20
NODE=M049R20

 $\Gamma(\gamma 3h^+ 3h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
$5.4 \pm 1.5 \pm 1.3$	39 ± 11

DOCUMENT ID

TECN

COMMENT

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{82}/Γ

NODE=M049R21
NODE=M049R21

 $\Gamma(\gamma 4h^+ 4h^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
$7.4 \pm 2.5 \pm 2.5$	36 ± 12

DOCUMENT ID

TECN

COMMENT

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{83}/Γ

NODE=M049R22
NODE=M049R22

 $\Gamma(\gamma \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS
$2.9 \pm 0.7 \pm 0.6$	29 ± 8

DOCUMENT ID

TECN

COMMENT

FULTON

90B

CLEO

 $e^+ e^- \rightarrow \text{hadrons}$ Γ_{84}/Γ

NODE=M049R14
NODE=M049R14

$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.7 \pm 0.5$	26 ± 7	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{85}/Γ

NODE=M049R13
 NODE=M049R13

 $\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.9 \pm 0.8$	17 ± 5	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{86}/Γ

NODE=M049R17
 NODE=M049R17

 $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.9 \pm 0.8$	18 ± 7	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{87}/Γ

NODE=M049R18
 NODE=M049R18

 $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.5 \pm 0.3$	22 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{88}/Γ

NODE=M049R15
 NODE=M049R15

 $\Gamma(\gamma 2\pi^+ 2\pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.4 \pm 0.4 \pm 0.4$	7 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{89}/Γ

NODE=M049R19
 NODE=M049R19

 $\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.2 ± 0.2	2 ± 2	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{90}/Γ

NODE=M049R16
 NODE=M049R16

 $\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.9	90	ATHAR	07A CLEO	$\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \pi^+ \pi^- \eta, \gamma \rho$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 16	90	RICHICHI	01B CLE2	$\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \eta \pi^+ \pi^-$

 Γ_{91}/Γ

NODE=M049R55
 NODE=M049R55

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.0	90	ATHAR	07A CLEO	$\Upsilon(1S) \rightarrow \gamma \eta \rightarrow \gamma \gamma \gamma, \gamma \pi^+ \pi^- \pi^0, \gamma 3\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 21	90	MASEK	02 CLEO	$\Upsilon(1S) \rightarrow \gamma \eta$

 Γ_{92}/Γ

NODE=M049R54
 NODE=M049R54

 $\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	¹ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

 Γ_{93}/Γ

NODE=M049R31
 NODE=M049R31

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 1$.

NODE=M049R31;LINKAGE=AT

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.6					OUR AVERAGE
[(2.9 ± 0.6) $\times 10^{-5}$ OUR 2023 AVERAGE]					

 Γ_{94}/Γ

NODE=M049R52
 NODE=M049R52
 NEW

$2.13 \pm 0.28 \pm 0.72$		¹ LEES	18A BABR	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
$4.0 \pm 1.4 \pm 0.1$	17	² BESSON	11 CLEO	$\Upsilon(1S) \rightarrow K_S^0 K_S^0$
$3.7 \pm 0.9 \pm 0.7$		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 14	90	³ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
< 19.4	90	³ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$

¹ Using $B(f'_2(1525) \rightarrow K\bar{K}) = 0.887 \pm 0.022$ and $B(K^0 \bar{K}^0) = 1/2 B(K\bar{K})$.

² BESSON 11 reports $(4.0 \pm 1.3 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\Upsilon(1S) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})]$ assuming $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 3.1) \times 10^{-2}$, which we rescale to our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (88.8 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. The result also assumes $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$ and $B(f'_2(1525) \rightarrow K\bar{K}) = 4 B(f'_2(1525) \rightarrow K_S^0 K_S^0)$.

³ Assuming $B(f'_2(1525) \rightarrow K\bar{K}) = 0.71$.

NODE=M049R52;LINKAGE=A
 NODE=M049R52;LINKAGE=BE

NODE=M049R52;LINKAGE=D

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
10.1 ± 0.6 OUR AVERAGE				
10.15 ± 0.59 ^{+0.54} _{-0.43}		¹ LEES	18A BABR	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
10.5 ± 1.6 ^{+1.9} _{-1.8}		² BESSON	07A CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$
10.2 ± 0.8 ± 0.7		ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
8.1 ± 2.3 ^{+2.9} _{-2.7}		³ ANASTASSOV	99 CLE2	$e^+ e^- \rightarrow \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	³ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<13	90	³ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<81	90	SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$
¹ Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = 1/3 B(f_2(1270) \rightarrow \pi \pi)$ and $B(f_2(1270) \rightarrow \pi \pi) = (84.2^{+2.9}_{-0.9})\%$.				
² Using $B(f_2(1270) \rightarrow \pi^0 \pi^0) = B(f_2(1270) \rightarrow \pi \pi)/3$ and $B(f_2(1270) \rightarrow \pi \pi) = (84.7^{+2.5}_{-1.2})\%$.				
³ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.				

NODE=M049R51
NODE=M049R51

NODE=M049R51;LINKAGE=A

NODE=M049R51;LINKAGE=BE

NODE=M049R51;LINKAGE=C

 $\Gamma(\gamma \eta(1405))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^\pm \pi^\mp K_S^0$

¹ Includes unknown branching ratio of $\eta(1405) \rightarrow K^\pm \pi^\mp K_S^0$.

NODE=M049R23
NODE=M049R23

NODE=M049R23;LINKAGE=J

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	¹ BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<6.1	90	² BESSON	07A CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$
¹ Using $B(f_0(1500) \rightarrow \pi^0 \pi^0) = B(f_0(1500) \rightarrow \pi \pi)/3$ and $B(f_0(1500) \rightarrow \pi \pi) = (0.349 \pm 0.023)\%$.				
² Calculated by us using $B(f_0(1500) \rightarrow \eta \eta) = (5.1 \pm 0.9)\%$.				

NODE=M049R44
NODE=M049R44

OCCUR=2

NODE=M049R44;LINKAGE=BE

NODE=M049R44;LINKAGE=BS

 $\Gamma(\gamma f_0(1500) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.04 ± 0.14 ± 0.33	¹ LEES	18A BABR	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$

¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1500) \rightarrow \gamma K \bar{K}) = (2.08 \pm 0.27 \pm 0.65) \times 10^{-5}$ assuming $B(K^0 \bar{K}^0) = 1/2 B(K \bar{K})$.

NODE=M049P29
NODE=M049P29

NODE=M049P29;LINKAGE=A

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.6	90	¹ ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.3	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
<19	90	¹ FULTON	90B CLEO	$\Upsilon(1S) \rightarrow \gamma K_S^0 K_S^0$
< 8	90	² ALBRECHT	89 ARG	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$
<24	90	³ SCHMITT	88 CBAL	$\Upsilon(1S) \rightarrow \gamma X$

¹ Assuming $B(f_0(1710) \rightarrow K \bar{K}) = 0.38$.

² Assuming $B(f_0(1710) \rightarrow \pi \pi) = 0.04$.

³ Assuming $B(f_0(1710) \rightarrow \eta \eta) = 0.18$.

NODE=M049R53
NODE=M049R53

OCCUR=2

OCCUR=2

NODE=M049R53;LINKAGE=E

NODE=M049R53;LINKAGE=F

NODE=M049R53;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.01 ± 0.26 ± 0.18		¹ LEES	18A BABR	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	ATHAR	06 CLEO	$e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma K^+ K^-$
¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1710) \rightarrow \gamma K \bar{K}) = (2.02 \pm 0.51 \pm 0.35) \times 10^{-5}$ assuming $B(K^0 \bar{K}^0) = 1/2 B(K \bar{K})$.				

NODE=M049R50
NODE=M049R50

NODE=M049R50;LINKAGE=A

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{101}/Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

0.53 ± 0.17 ± 0.11¹

LEES

18A

BABR

 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

¹ LEES 18A quotes $B(\Upsilon(1S) \rightarrow \gamma f_0(1710) \rightarrow \gamma \pi \pi) = (0.79 \pm 0.26 \pm 0.17) \times 10^{-5}$ assuming $B(\pi^0 \pi^0) = 1/3 B(\pi \pi)$.

NODE=M049P28
NODE=M049P28

NODE=M049P28;LINKAGE=A

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{102}/Γ VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

<1.4

90

BESSON

07A

CLEO

 $e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \pi^0 \pi^0$

NODE=M049R45
NODE=M049R45

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{103}/Γ VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

<1.8

90

BESSON

07A

CLEO

 $e^+ e^- \rightarrow \Upsilon(1S) \rightarrow \gamma \eta \eta$

NODE=M049R46
NODE=M049R46

 $\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$ Γ_{104}/Γ VALUE (units 10^{-5})

CL%

DOCUMENT ID

TECN

COMMENT

<5.3

90

¹

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

¹ Assuming $B(f_4(2050) \rightarrow \pi \pi) = 0.17$.

NODE=M049R30
NODE=M049R30

NODE=M049R30;LINKAGE=AT

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.0002

90

BARU

89

MD1

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R63
NODE=M049R63

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K^+ K^-)/\Gamma_{\text{total}}$ Γ_{106}/Γ VALUE (units 10^{-7})

CL%

DOCUMENT ID

TECN

COMMENT

< 8

90

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 160

90

MASEK

02

CLEO

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

< 150

90

FULTON

90B

CLEO

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

< 290

90

ALBRECHT

89

ARG

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

<2000

90

BARU

89

MD1

 $\Upsilon(1S) \rightarrow \gamma K^+ K^-$

NODE=M049R56
NODE=M049R56

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{107}/Γ VALUE (units 10^{-7})

CL%

DOCUMENT ID

TECN

COMMENT

< 6

90

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<120

90

MASEK

02

CLEO

 $\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M049R41
NODE=M049R41

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{108}/Γ VALUE (units 10^{-7})

CL%

DOCUMENT ID

TECN

COMMENT

< 11

90

ATHAR

06

CLE3

 $\Upsilon(1S) \rightarrow \gamma p \bar{p}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<160

90

MASEK

02

CLEO

 $\Upsilon(1S) \rightarrow \gamma p \bar{p}$

NODE=M049R42
NODE=M049R42

 $\Gamma(\gamma \eta(2225) \rightarrow \gamma \phi \phi)/\Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.003

90

BARU

89

MD1

 $\Upsilon(1S) \rightarrow \gamma K^+ K^- K^+ K^-$

NODE=M049R62
NODE=M049R62

 $\Gamma(\gamma \eta_c(1S))/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<2.9 × 10⁻⁵

90

¹

KATRENKO

20

BELL

 $e^+ e^- \rightarrow \gamma + \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<5.7 × 10⁻⁵

90

SHEN

10A

BELL

 $\Upsilon(1S) \rightarrow \gamma X$

¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-$ decays.

NODE=M049R38
NODE=M049R38

NODE=M049R38;LINKAGE=A

 $\Gamma(\gamma \eta_c(2S))/\Gamma_{\text{total}}$ Γ_{111}/Γ

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<4 × 10⁻⁴

90

¹

KATRENKO

20

BELL

 $e^+ e^- \rightarrow \gamma + \text{hadrons}$

¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S) \pi^+ \pi^-$ decays.

NODE=M049P30
NODE=M049P30

NODE=M049P30;LINKAGE=A

$\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-5}$	90	¹ KATRENKO 20	BELL	$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<6.5 \times 10^{-4}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.				

 Γ_{112}/Γ

NODE=M049R39
 NODE=M049R39

NODE=M049R39;LINKAGE=A

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$4.7^{+2.4+0.4}_{-1.8-0.5}$	5	¹ KATRENKO 20	BELL		$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.3	90	SHEN 10A	BELL		$\Upsilon(1S) \rightarrow \gamma X$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.					

 Γ_{113}/Γ

NODE=M049R40
 NODE=M049R40

NODE=M049R40;LINKAGE=A

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.6 \times 10^{-6}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<3.3 \times 10^{-5}$	90	¹ KATRENKO 20	BELL	$\Upsilon(1S) \rightarrow \gamma + \text{hadrons}$
¹ Using $\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-$ decays.				

 Γ_{114}/Γ

NODE=M049R48
 NODE=M049R48

NODE=M049R48;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5 \times 10^{-5}$ (CL = 90%)		[$<4 \times 10^{-5}$ (CL = 90%) OUR 2023 BEST LIMIT]		
$<5 \times 10^{-5}$	90	¹ SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$
¹ SHEN 10A reports $[\Gamma(\Upsilon(1S) \rightarrow \gamma\chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S))] < 1.6 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 3.5 \times 10^{-2}$.				

 Γ_{115}/Γ

NODE=M049P32
 NODE=M049P32

NODE=M049P32;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-6}$	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{116}/Γ

NODE=M049R68
 NODE=M049R68

 $\Gamma(\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{117}/Γ

NODE=M049R69
 NODE=M049R69

 $\Gamma(\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	SHEN 10A	BELL	$\Upsilon(1S) \rightarrow \gamma X$

 Γ_{118}/Γ

NODE=M049R74
 NODE=M049R74

 $\Gamma(\gamma X \bar{X}(m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ (X $\bar{X}$ = vectors with $m < 3.1 \text{ GeV}$)

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	¹ BALEST 95	CLEO	$e^+e^- \rightarrow \gamma + X \bar{X}$

 Γ_{119}/Γ

NODE=M049R61
 NODE=M049R61
 NODE=M049R61

NODE=M049R61;LINKAGE=A

 $\Gamma(\gamma X \bar{X}(m_X < 4.5 \text{ GeV}))/\Gamma_{\text{total}}$ X and $\bar{X}$ = zero spin with $m < 4.5 \text{ GeV}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	¹ DEL-AMO-SA..11J	BABR	$e^+e^- \rightarrow \gamma + X \bar{X}$

 Γ_{120}/Γ

NODE=M049R01
 NODE=M049R01
 NODE=M049R01

NODE=M049R01;LINKAGE=DA

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ (1.5 GeV $< m_X < 5.0 \text{ GeV}$)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.78	95	ROSNER 07A	CLEO	$e^+e^- \rightarrow \gamma X$

 Γ_{121}/Γ

NODE=M049R64
 NODE=M049R64
 NODE=M049R64

$\Gamma(\gamma A^0)/\Gamma_{\text{total}}$ $(A^0 = \text{scalar with } m < 8.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 4.5 \times 10^{-6}$	90	¹ DEL-AMO-SA...11J	BABR	$e^+e^- \rightarrow \gamma + X$
$< 3 \times 10^{-5}$	90	² BALEST	95 CLEO	$e^+e^- \rightarrow \gamma + X$
$< 5.6 \times 10^{-5}$	90	² ANTREASYAN 90C	CBAL	$e^+e^- \rightarrow \gamma + X$

¹ For a non-interacting scalar or pseudoscalar, A^0 , with mass $m_{A^0} < 8.0 \text{ GeV}$. 90% CL upper limits range from 1.9×10^{-6} to 4.5×10^{-6} .

² For any non-interacting long-lived particle with mass $< 7.2 \text{ GeV}$.

 Γ_{122}/Γ

NODE=M049R60

NODE=M049R60

NODE=M049R60

NODE=M049R60;LINKAGE=DA

NODE=M049R60;LINKAGE=A

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ $(201 < M(\mu^+ \mu^-) < 3565 \text{ MeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

< 9	90	¹ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 16	90	² JIA	22 BELL	$\Upsilon(2S) \rightarrow \gamma \mu^+ \mu^- \pi^+ \pi^-$
< 9.7	90	³ LEES	13C BABR	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with $201 < M(\mu^+ \mu^-) < 3565 \text{ MeV}$, excluding J/ψ . Measured 90% CL limits as a function of $M(\mu^+ \mu^-)$ range from $1-9 \times 10^{-6}$.

² For a narrow scalar or pseudoscalar, A^0 , with $0.22 < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits ranging from 3.1×10^{-7} at $M(A^0) = 0.22 \text{ GeV}$ to 1.6×10^{-5} at $M(A^0) = 9.2 \text{ GeV}$.

³ For a narrow scalar or pseudoscalar, A^0 , with mass in the range $0.212-9.2 \text{ GeV}$, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} are in the range $0.28-9.7 \times 10^{-6}$.

 Γ_{123}/Γ

NODE=M049R65

NODE=M049R65

NODE=M049R65

NODE=M049R65;LINKAGE=LO

NODE=M049R65;LINKAGE=A

NODE=M049R65;LINKAGE=LE

 $\Gamma(\gamma A^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ $(2m_\tau < M(\tau^+ \tau^-) < 9.2 \text{ GeV})$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

< 130	90	¹ LEES	13R BABR	$\Upsilon(2S) \rightarrow \gamma \tau^+ \tau^- \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 150	90	² JIA	22 BELL	$\Upsilon(2S) \rightarrow \gamma \tau^+ \tau^- \pi^+ \pi^-$
< 50	90	³ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \tau^+ \tau^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits of 0.9×10^{-5} at $M(A^0) = 2m_\tau$, $\approx 1.5 \times 10^{-5}$ at $M(A^0) = 7.5 \text{ GeV}$, and 13×10^{-5} at $M(A^0) = 9.2 \text{ GeV}$.

² For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 9.2 \text{ GeV}$, resulting in 90% CL upper limits ranging from 3.8×10^{-6} at $M(A^0) = 2m_\tau$ to 1.5×10^{-4} at $M(A^0) = 9.2 \text{ GeV}$.

³ For a narrow scalar or pseudoscalar, A^0 , with $2m_\tau < M(A^0) < 7.5 \text{ GeV}$, resulting in 90% CL limits ranging from 1×10^{-5} at $M(A^0)=2m_\tau$ to 5×10^{-5} at $M(A^0)=7.5 \text{ GeV}$.

 Γ_{124}/Γ

NODE=M049R66

NODE=M049R66

NODE=M049R66

NODE=M049R66;LINKAGE=A

NODE=M049R66;LINKAGE=B

NODE=M049R66;LINKAGE=LO

 $\Gamma(\gamma A^0 \rightarrow \gamma g g)/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1 $\times 10^{-2}$	90	¹ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$

¹ For a narrow, CP -odd pseudoscalar, A^0 , searched for in 26 hadronic decay modes with invariant mass $0.5 \text{ GeV} < m_{A^0} < 9.0 \text{ GeV}$. Measured 90% CL limits as a function of m_{A^0} range from 10^{-6} to 10^{-2} .

 Γ_{125}/Γ

NODE=M049R03

NODE=M049R03

NODE=M049R03

NODE=M049R03;LINKAGE=A

 $\Gamma(\gamma A^0 \rightarrow \gamma s \bar{s})/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1 $\times 10^{-3}$	90	¹ LEES	13L BABR	$\Upsilon(1S) \rightarrow \gamma X$

¹ For a narrow, CP -odd pseudoscalar, A^0 , searched for in 14 hadronic decay modes with invariant mass $1.5 \text{ GeV} < m_{A^0} < 9.0 \text{ GeV}$. Measured 90% CL limits as a function of m_{A^0} range from 10^{-5} to 10^{-3} .

 Γ_{126}/Γ

NODE=M049R04

NODE=M049R04

NODE=M049R04

NODE=M049R04;LINKAGE=A

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M049230

 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT

< 3.9	90	PATRA	22 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- e^\pm \mu^\mp$

 Γ_{127}/Γ

NODE=M049P33

NODE=M049P33

$\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{128}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.7 \times 10^{-6}$	90	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- \mu^\pm \tau^\mp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<6.0 \times 10^{-6}$	95	LOVE	08A	CLEO $e^+ e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049R67
NODE=M049R67

$\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{129}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- e^\pm \tau^\mp$

NODE=M049P34
NODE=M049P34

$\Gamma(\gamma e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{130}/Γ

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
<4.2	90	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma e^\pm \mu^\mp$

NODE=M049P35
NODE=M049P35

$\Gamma(\gamma \mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{131}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.1	90	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma \mu^\pm \tau^\mp$

NODE=M049P36
NODE=M049P36

$\Gamma(\gamma e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{132}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.5	90	PATRA	22	BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- \gamma e^\pm \tau^\mp$

NODE=M049P37
NODE=M049P37

OTHER DECAYS

$\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{133}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.0	90	AUBERT	09AX	BABR $\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<39	90	RUBIN	07	CLEO $\Upsilon(2S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$
<25	90	TAJIMA	07	BELL $\Upsilon(3S) \rightarrow \pi^+ \pi^- \Upsilon(1S)$

NODE=M049235

NODE=M049R10
NODE=M049R10

$\Upsilon(1S)$ REFERENCES

SHAMOV	23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
JIA	22	PRL 128 081804	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=61657
PATRA	22	JHEP 2205 095	S. Patra <i>et al.</i>	(BELLE Collab.)	REFID=61653
KATRENKO	20	PRL 124 122001	P. Katrenko <i>et al.</i>	(BELLE Collab.)	REFID=60544
JIA	18	PR D97 112004	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58949
LEES	18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58950
JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=57635
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
SHEN	16	PR D93 112013	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=57515
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
LEES	13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54949
LEES	13L	PR D88 031701	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55167
LEES	13R	PR D88 071102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55451
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
BESSION	11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=16737
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16495
AUBERT	10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53211
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=53354
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53545
AUBERT	09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53201
LOVE	08	PRL 101 151802	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52565
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
ATHAR	07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=51945
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
BESSION	07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51638
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079
RUBIN	07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)	REFID=51629
TAJIMA	07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=51645
AQUINES	06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51510
ATHAR	06	PR D73 032001	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=50993
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51147
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=51035
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)	REFID=50452
BRIERE	04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=50183
ARTUSO	03	PR D67 052003	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=49395
MASEK	02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)	REFID=48846
RICHICHI	01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)	REFID=48345
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424

NODE=M049

ANASTASSOV	99	PRL 82 286	A. Anastassov <i>et al.</i>	(CLEO Collab.)
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)
BALEST	95	PR D51 2053	R. Balest <i>et al.</i>	(CLEO Collab.)
CINABRO	94B	PL B340 129	D. Cinabro <i>et al.</i>	(CLEO Collab.)
ALBRECHT	92J	ZPHY C55 25	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BARU	92	ZPHY C54 229	S.E. Baru <i>et al.</i>	(NOVO)
BARU	92B	ZPHY C56 547	S.E. Baru <i>et al.</i>	(NOVO)
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)
ANTREASYAN	90C	PL B251 204	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)
BLINOV	90	PL B245 311	A.E. Blinov <i>et al.</i>	(NOVO)
FULTON	90B	PR D41 1401	R. Fulton <i>et al.</i>	(CLEO Collab.)
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	89	NP B320 45	J.P. Alexander <i>et al.</i>	(LBL, MICH, SLAC)
BARU	89	ZPHY C42 505	S.E. Baru <i>et al.</i>	(NOVO)
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
FULTON	89	PL B224 445	R. Fulton <i>et al.</i>	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding, World Scientific, Singapore				
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.) IGJPC
SCHMITT	88	ZPHY C40 199	P. Schmitt <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86	ZPHY C30 551	S.E. Baru <i>et al.</i>	(NOVO)
ALBRECHT	85C	PL 154B 452	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KURAEV	85	JNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
Translated from YAF 41 733				
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
BESSION	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
MACKAY	84	PR D29 2483	W.W. MacKay <i>et al.</i>	(CUSB Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GILES	83	PRL 50 877	R. Giles <i>et al.</i>	(HARV, OSU, ROCH, RUTG+)
NICZYPORUK	83	ZPHY C17 197	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)
ARTAMONOV	82	PL 118B 225	A.S. Artamonov <i>et al.</i>	(NOVO)
NICZYPORUK	82	ZPHY C15 299	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
BERGER	80C	PL 93B 497	C. Berger <i>et al.</i>	(PLUTO Collab.)
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)
BERGER	79	ZPHY C1 343	C. Berger <i>et al.</i>	(PLUTO Collab.)

REFID=46609
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REFID=40918
REFID=40733
REFID=40034

$\chi_{b0}(1P)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M076

NODE=M076

$\chi_{b0}(1P)$ MASS

NODE=M076M

VALUE (MeV)	DOCUMENT ID
9859.44±0.42±0.31 OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$
mass = 10023.26 ± 0.31 MeV	

NODE=M076M
→ UNCHECKED ←

$m_{\chi_{b1}(1P)} - m_{\chi_{b0}(1P)}$	DOCUMENT ID	TECN	COMMENT
32.49±0.93	LEES	14M	BABR $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M076M2
NODE=M076M2

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M076DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
162.5 ±0.4 OUR AVERAGE			
162.56±0.19±0.42	ARTUSO	05	CLEO $\Upsilon(2S) \rightarrow \gamma X$
162.0 ±0.8 ±1.2	EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma\chi(1P)$
162.1 ±0.5 ±1.4	ALBRECHT	85E	ARG $\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
163.8 ±1.6 ±2.7	NERNST	85	CBAL $\Upsilon(2S) \rightarrow \gamma X$
158.0 ±7 ±1	HAAS	84	CLEO $\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
149.4 ±0.7 ±5.0	KLOPFEN...	83	CUSB $\Upsilon(2S) \rightarrow \gamma X$

NODE=M076DM

$\chi_{b0}(1P)$ DECAY MODES

NODE=M076215;NODE=M076

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(1.94 ± 0.27) %	
$\Gamma_2 \quad D^0 X$	< 10.4 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 $\times 10^{-4}$	90%
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 5 $\times 10^{-5}$	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 $\times 10^{-4}$	90%
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.1 $\times 10^{-4}$	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) $\times 10^{-4}$	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 $\times 10^{-4}$	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 $\times 10^{-4}$	90%
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 $\times 10^{-4}$	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	< 8 $\times 10^{-5}$	90%
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	< 6 $\times 10^{-4}$	90%
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	(2.4 ± 1.2) $\times 10^{-4}$	
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 $\times 10^{-3}$	90%
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	< 8 $\times 10^{-5}$	90%
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	< 2.1 $\times 10^{-3}$	90%
$\Gamma_{17} \quad J/\psi J/\psi$	< 7 $\times 10^{-5}$	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	< 1.2 $\times 10^{-4}$	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	< 3.1 $\times 10^{-5}$	90%
$\Gamma_{20} \quad J/\psi(1S) \text{anything}$	< 2.3 $\times 10^{-3}$	90%

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

DESIG=20

 $\chi_{b0}(1P)$ BRANCHING RATIOS

NODE=M076220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE (%)	CL% EVTS

1.94 ± 0.27 OUR AVERAGE

2.07 ± 0.24 ± 0.21

1,2 LEES

14M

BABR

 $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

1.76 ± 0.30 ± 0.18

87

3,4 KORNICER

11

CLEO

 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4.6

90

5 LEES

11J

BABR

 $\Upsilon(2S) \rightarrow X \gamma$

< 6

90

WALK

86

CBAL

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

< 11

90

PAUSS

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ LEES 14M quotes $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (7.75 \pm 0.91) \times 10^{-4}$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons. Assumes $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

² LEES 14M reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (7.75 \pm 0.91) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴ KORNICER 11 reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (6.59 \pm 0.96 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$.

NODE=M076R1;LINKAGE=A

NODE=M076R1;LINKAGE=B

NODE=M076R1;LINKAGE=KA

NODE=M076R1;LINKAGE=KR

NODE=M076R1;LINKAGE=LE

$\Gamma(D^0 X)/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	CL%

< 10.4 $\times 10^{-2}$

90

6,7 BRIERE

08

CLEO

 $\Upsilon(2S) \rightarrow \gamma D^0 X$ ⁶ For $p_{D^0} > 2.5$ GeV/c.⁷ The authors also present their result as $(5.6 \pm 3.6 \pm 0.5) \times 10^{-2}$.

NODE=M076R01

NODE=M076R01

NODE=M076R01;LINKAGE=BR

NODE=M076R01;LINKAGE=RI

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE (units 10^{-4})	CL%

< 1.6

90

8 ASNER

08A

CLEO

 $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R02

NODE=M076R02

NODE=M076R02;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$ ⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R03
NODE=M076R03

NODE=M076R03;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$ ¹⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 18 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R04
NODE=M076R04

NODE=M076R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$ ¹¹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 8 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R05
NODE=M076R05

NODE=M076R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.6 \pm 0.1$	7	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$ ¹² ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] = (4 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M076R06
NODE=M076R06

NODE=M076R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$ ¹³ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R07
NODE=M076R07

NODE=M076R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$ ¹⁴ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 20 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R08
NODE=M076R08

NODE=M076R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$ ¹⁵ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R09
NODE=M076R09

NODE=M076R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$ ¹⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R10
NODE=M076R10

NODE=M076R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$ ¹⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 22 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M076R11
NODE=M076R11

NODE=M076R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 1.2 \pm 0.2$	9	18 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $= (9 \pm 4 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M076R12
 NODE=M076R12

NODE=M076R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	19 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 37 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R13
 NODE=M076R13

NODE=M076R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	20 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
20 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R14
 NODE=M076R14

NODE=M076R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21	90	21 ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
21 ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 77 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

NODE=M076R15
 NODE=M076R15

NODE=M076R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
22 SHEN 12 reports $< 7.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R16
 NODE=M076R16

NODE=M076R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	23 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
23 SHEN 12 reports $< 12 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R17
 NODE=M076R17

NODE=M076R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	24 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
24 SHEN 12 reports $< 3.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

NODE=M076R18
 NODE=M076R18

NODE=M076R18;LINKAGE=SH

 $\Gamma(J/\psi(1S) \text{anything})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.3 \times 10^{-3}$	90	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M076R00
 NODE=M076R00

 $\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M076230

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{73}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-3}$	90	25 LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$
25 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.				

NODE=M076B02
 NODE=M076B02

NODE=M076B02;LINKAGE=LE

$B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

VALUE (units 10 ⁻⁵)	EVTs	DOCUMENT ID	TECN	COMMENT

1.67±0.28 OUR AVERAGE

2.9 ^{+1.7} _{-1.4} ^{+0.1} _{-0.8}	26	LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
1.63±0.24±0.15	87	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
²⁶ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.				

$[B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$

VALUE (%)	DOCUMENT ID	TECN	COMMENT

3.28±0.37

²⁷From a sample of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ without converted photons.

NODE=M076B01
NODE=M076B01

NODE=M076B01;LINKAGE=A

NODE=M076A01
NODE=M076A01

NODE=M076A01;LINKAGE=A

χ_{b0}(1P) REFERENCES

JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

NODE=M076

REFID=58318
REFID=56343
REFID=54313
REFID=16769
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=46612
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286

NODE=M077

$\chi_{b1}(1P)$

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore *C* = +. Branching ratio requires *E1* transition, *M1* is strongly disfavored, therefore *P* = +. *J* = 1 from SKWARNICKI 87.

NODE=M077

χ_{b1}(1P) MASS

VALUE (MeV)	DOCUMENT ID
9892.78±0.26±0.31 OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$
mass = 10023.26 ± 0.31 MeV	

NODE=M077M

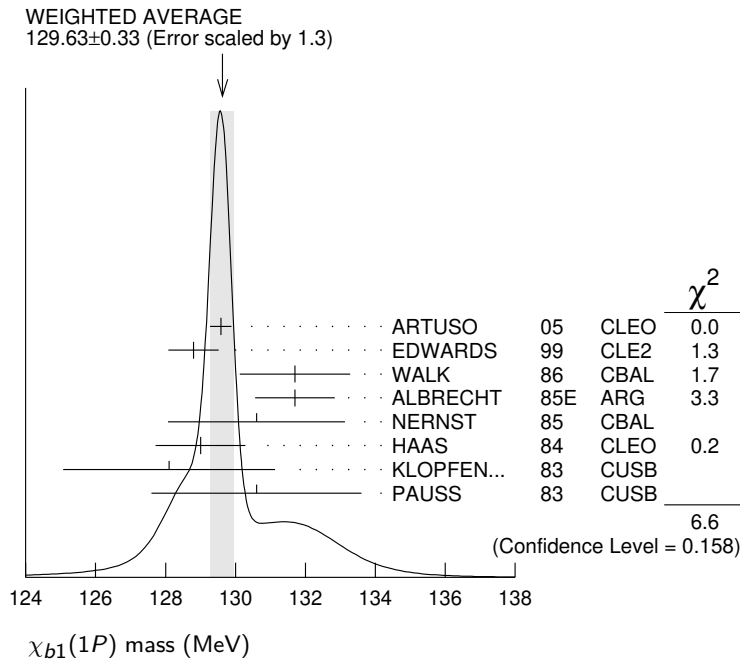
NODE=M077M
→ UNCHECKED ←

γ ENERGY IN Υ(2S) DECAY

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
129.63±0.33 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.		
129.58±0.09±0.29	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
128.8 ±0.4 ±0.6	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma \chi(1P)$
131.7 ±0.9 ±1.3	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
131.7 ±0.3 ±1.1	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
130.6 ±0.8 ±2.4	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
129 ±0.8 ±1	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.} \gamma X$
128.1 ±0.4 ±3.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ±3.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M077DM

NODE=M077DM



$\chi_{b1}(1P)$ DECAY MODES

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1 $\gamma \Upsilon(1S)$	(35.2 ± 2.0) %		DESIG=1
Γ_2 $D^0 X$	(12.6 ± 2.2) %		DESIG=2
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(2.0 ± 0.6) × 10 ⁻⁴		DESIG=3
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	(1.3 ± 0.5) × 10 ⁻⁴		DESIG=4
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	90%	DESIG=5
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(8.0 ± 2.5) × 10 ⁻⁴		DESIG=6
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.5 ± 0.5) × 10 ⁻⁴		DESIG=7
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5 ± 1.2) × 10 ⁻⁴		DESIG=8
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6 ± 3.2) × 10 ⁻⁴		DESIG=9
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(9.3 ± 3.3) × 10 ⁻⁴		DESIG=10
Γ_{11} $3\pi^+ 3\pi^-$	(1.9 ± 0.6) × 10 ⁻⁴		DESIG=11
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.7 ± 0.5) × 10 ⁻³		DESIG=12
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	(2.6 ± 0.8) × 10 ⁻⁴		DESIG=13
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(7.5 ± 2.6) × 10 ⁻⁴		DESIG=14
Γ_{15} $4\pi^+ 4\pi^-$	(2.6 ± 0.9) × 10 ⁻⁴		DESIG=15
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.4 ± 0.6) × 10 ⁻³		DESIG=16
Γ_{17} ω anything	(4.9 ± 1.4) %		DESIG=21
Γ_{18} ωX_{tetra}	< 4.44 × 10 ⁻⁴	90%	DESIG=22
Γ_{19} $J/\psi J/\psi$	< 2.7 × 10 ⁻⁵	90%	DESIG=17
Γ_{20} $J/\psi \psi(2S)$	< 1.7 × 10 ⁻⁵	90%	DESIG=18
Γ_{21} $\psi(2S) \psi(2S)$	< 6 × 10 ⁻⁵	90%	DESIG=19
Γ_{22} $J/\psi(1S)$ anything	< 1.1 × 10 ⁻³	90%	DESIG=20
Γ_{23} $J/\psi(1S) X_{tetra}$	< 2.27 × 10 ⁻⁴	90%	DESIG=23

$\chi_{b1}(1P)$ BRANCHING RATIOS

NODE=M077220

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{total}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.352±0.020 OUR AVERAGE					
0.356 ^{+0.016} _{-0.022} ± 0.019	964k	¹ FULSOM	18 BELL	$\Upsilon(2S) \rightarrow \gamma X$	
0.364 ± 0.017 ± 0.019		^{2,3,4} LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$	
0.331 ± 0.018 ± 0.017	3222	^{4,5} KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$	
0.350 ± 0.023 ± 0.018	13k	⁶ LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$	
0.34 ± 0.07 ± 0.02	53	^{4,7,8} WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	
0.47 ± 0.18		KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	

NODE=M077R1
NODE=M077R1

OCCUR=4

- ¹ FULSOM 18 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.45 \pm 0.02^{+0.11}_{-0.15}) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² LEES 14M quotes $\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}} = (2.51 \pm 0.12) \%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.
- ³ LEES 14M reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.51 \pm 0.12) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁴ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.
- ⁵ KORNICER 11 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁶ LEES 11J reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ⁷ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.8 \pm 0.9 \pm 0.7) \%$.
- ⁸ WALK 86 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (23.4 \pm 3.63 \pm 2.82) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R1;LINKAGE=J

NODE=M077R1;LINKAGE=B

NODE=M077R1;LINKAGE=D

NODE=M077R1;LINKAGE=KA

NODE=M077R1;LINKAGE=KR

NODE=M077R1;LINKAGE=LE

NODE=M077R1;LINKAGE=A

NODE=M077R1;LINKAGE=C

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
12.6±1.9±1.1	2310	¹ BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

¹ For $p_{D^0} > 2.5$ GeV/c.NODE=M077R01
NODE=M077R01

NODE=M077R01;LINKAGE=BR

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.6±0.1	18	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (14 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R02
NODE=M077R02

NODE=M077R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.5±0.1	11	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (9 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R03
NODE=M077R03

NODE=M077R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] < 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04
NODE=M077R04

NODE=M077R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.0±2.4±0.4	46	¹ ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (55 \pm 9 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M077R05
NODE=M077R05

NODE=M077R05;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.5±0.5±0.1	18	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (10 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R06
 NODE=M077R06

NODE=M077R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5±1.2±0.2	22	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24 \pm 6 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R07
 NODE=M077R07

NODE=M077R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.6±3.2±0.4	26	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (59 \pm 14 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R08
 NODE=M077R08

NODE=M077R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.3±3.3±0.5	21	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (64 \pm 16 \pm 16) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R09
 NODE=M077R09

NODE=M077R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.6±0.1	25	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (13 \pm 3 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R10
 NODE=M077R10

NODE=M077R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
17±5±1	56	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (119 \pm 18 \pm 32) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R11
 NODE=M077R11

NODE=M077R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.6±0.8±0.1	21	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (18 \pm 4 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R12
 NODE=M077R12

NODE=M077R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±2.6±0.4	28	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (52 \pm 11 \pm 14) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M077R13
 NODE=M077R13

NODE=M077R13;LINKAGE=AS

$\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.6 \pm 0.9 \pm 0.1$	24	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (18 \pm 4 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$
 $(6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

 Γ_{15}/Γ

NODE=M077R14
 NODE=M077R14

NODE=M077R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$14 \pm 5 \pm 1$	26	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$
 $= (96 \pm 24 \pm 29) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$
 $(6.9 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.

 Γ_{16}/Γ

NODE=M077R15
 NODE=M077R15

NODE=M077R15;LINKAGE=AS

 $\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 1.3 \pm 0.6$	51k	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{17}/Γ

NODE=M077R19
 NODE=M077R19

 $\Gamma(\omega X_{\text{tetra}})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 44.4 \times 10^{-5}$	90	¹ JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{18}/Γ

NODE=M077R23
 NODE=M077R23

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the
range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range
from 3.3×10^{-5} to 44.4×10^{-5} .

NODE=M077R23;LINKAGE=A

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

 Γ_{19}/Γ

NODE=M077R16
 NODE=M077R16

¹ SHEN 12 reports $< 2.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.

NODE=M077R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

 Γ_{20}/Γ

NODE=M077R17
 NODE=M077R17

¹ SHEN 12 reports $< 1.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times$
 10^{-2} .

NODE=M077R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 6	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

 Γ_{21}/Γ

NODE=M077R18
 NODE=M077R18

¹ SHEN 12 reports $< 6.2 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b1}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}]$
 $\times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times$
 10^{-2} .

NODE=M077R18;LINKAGE=SH

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.1 \times 10^{-3}$	90	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{22}/Γ

NODE=M077R00
 NODE=M077R00

 $\Gamma(J/\psi(1S) X_{\text{tetra}})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 22.7 \times 10^{-5}$	90	¹ JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

 Γ_{23}/Γ

NODE=M077R22
 NODE=M077R22

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the
range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range
from 1.8×10^{-5} to 22.7×10^{-5} .

NODE=M077R22;LINKAGE=A

 $\chi_{b1}(1P)$ Cross-Particle Branching Ratios

NODE=M077230

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{71}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$24.1 \pm 0.6 \pm 1.5$	13k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M077B03
 NODE=M077B03

$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-4}) EVTS DOCUMENT ID TECN COMMENT

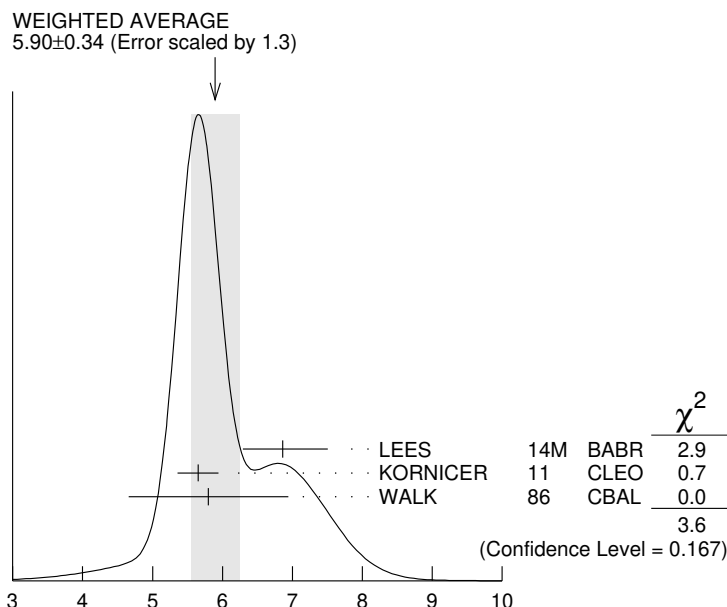
5.90±0.34 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

$6.86^{+0.47+0.44}_{-0.45-0.35}$		¹ LEES	14M	BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$5.65 \pm 0.11 \pm 0.27$	3222	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$5.8 \pm 0.9 \pm 0.7$	53	WALK	86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.

NODE=M077B01
NODE=M077B01

NODE=M077B01;LINKAGE=A



$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

(units 10^{-4})

$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5}) EVTS DOCUMENT ID TECN COMMENT

1.30±0.34 OUR AVERAGE

$1.16^{+0.78+0.14}_{-0.67-0.16}$		¹ LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$1.33 \pm 0.30 \pm 0.23$	50	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.

NODE=M077B02
NODE=M077B02

NODE=M077B02;LINKAGE=A

$$B(\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE DOCUMENT ID TECN COMMENT

1.068±0.010±0.040 BRIERE 07 CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R20
NODE=M077R20

$$B(\chi_{b0}(1P) \rightarrow \rho X + \bar{\rho} X) / B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$$

VALUE DOCUMENT ID TECN COMMENT

1.11±0.15±0.20 BRIERE 07 CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R21
NODE=M077R21

$\chi_{b1}(1P)$ REFERENCES

FULSOM 18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)
JIA 17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)
LEES 14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN 12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER 11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES 11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER 08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE 08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE 07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO 05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS 99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI 87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)
WALK 86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT 85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST 85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS 84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN... 83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS 83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

NODE=M077

REFID=59535
REFID=58318
REFID=56343
REFID=54313
REFID=16769
REFID=53936
REFID=52574
REFID=52577
REFID=51887
REFID=50454
REFID=46612
REFID=40019
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REFID=22287
REFID=22285
REFID=22286

NODE=M204

NODE=M204

NODE=M204M

NODE=M204M

NODE=M204M;LINKAGE=AD

NODE=M204215;NODE=M204

DESIG=1

NODE=M204225

NODE=M204R01
NODE=M204R01

NODE=M204R01;LINKAGE=A

NODE=M204

REFID=56996
REFID=53962
REFID=54718
REFID=53937

$$h_b(1P)$$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

$h_b(1P)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
9899.3±0.8 OUR AVERAGE				
9899.3±0.4±1.0	112k	TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
9899.1±0.4±1.0	70k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^-\text{hadrons}$
9902 ±4 ±2	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9898.2 ^{+1.1+1.0} _{-1.0-1.1}	50.0k	¹ ADACHI	12	BELL $10.86\ e^+e^- \rightarrow \pi^+\pi^-\text{MM}$
¹ Superseded by MIZUK 12.				

$h_b(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S)\gamma$	(52 ⁺⁶ ₋₅) %

$h_b(1P)$ BRANCHING RATIOS

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT	
52 ⁺⁶₋₅ OUR AVERAGE					
56 ±8 ±4	33.1k	¹ TAMPONI	15	BELL $e^+e^- \rightarrow \gamma\eta + \text{hadrons}$	
49.2±5.7 ^{+5.6} _{-3.3}	24k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-\text{hadrons}$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	10.8k	LEES	11k	BABR $\Upsilon(3S) \rightarrow \eta_b \gamma \pi^0$	
¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.					

$h_b(1P)$ REFERENCES

TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)

$\chi_{b2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(2S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$. $J = 2$ from SKWARNICKI 87.

NODE=M078

NODE=M078

 $\chi_{b2}(1P)$ MASS

NODE=M078M

VALUE (MeV)

DOCUMENT ID

9912.21 $\pm$ 0.26 $\pm$ 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 $\pm$ 0.31 MeV

NODE=M078M

→ UNCHECKED ←

 $m_{\chi_{b2}(1P)} - m_{\chi_{b1}(1P)}$

NODE=M078DM2

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

19.10 $\pm$ 0.25 OUR AVERAGE Error includes scale factor of 1.1.

19.81 $\pm$ 0.65 $\pm$ 0.20¹ AAIJ

14BG LHCb

 $pp \rightarrow \gamma \mu^+ \mu^- X$ 19.01 $\pm$ 0.24

LEES

14M BABR

 $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

¹ From the $\chi_{bj}(1P) \rightarrow \Upsilon(1S)\gamma$ transition.

NODE=M078DM2

NODE=M078DM2;LINKAGE=A

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M078DM

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

110.44 $\pm$ 0.29 OUR AVERAGE Error includes scale factor of 1.1.

110.58 $\pm$ 0.08 $\pm$ 0.30

ARTUSO

05

CLEO

 $\Upsilon(2S) \rightarrow \gamma X$ 110.8 $\pm$ 0.3 $\pm$ 0.6

EDWARDS

99

CLE2

 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$ 107.0 $\pm$ 1.1 $\pm$ 1.3

WALK

86

CBAL

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$ 110.6 $\pm$ 0.3 $\pm$ 0.9

ALBRECHT

85E

ARG

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$ 110.4 $\pm$ 0.8 $\pm$ 2.2

NERNST

85

CBAL

 $\Upsilon(2S) \rightarrow \gamma X$ 109.5 $\pm$ 0.7 $\pm$ 1.0

HAAS

84

CLEO

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$ 108.2 $\pm$ 0.3 $\pm$ 2.0

KLOPFEN...

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma X$ 108.8 $\pm$ 4.0

PAUSS

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M078DM

 $\chi_{b2}(1P)$ DECAY MODES

NODE=M078215;NODE=M078

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(18.0 $\pm$ 1.0) %	
Γ_2 $D^0 X$	< 7.9 %	90%
Γ_3 $\pi^+ \pi^- K^+ K^- \pi^0$	(8 $\pm$ 5) $\times 10^{-5}$	
Γ_4 $2\pi^+ \pi^- K^- K_S^0$	< 1.0 $\times 10^{-4}$	90%
Γ_5 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	(5.3 $\pm$ 2.4) $\times 10^{-4}$	
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	(3.5 $\pm$ 1.4) $\times 10^{-4}$	
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.1 $\pm$ 0.4) $\times 10^{-4}$	
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.1 $\pm$ 0.9) $\times 10^{-4}$	
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(3.9 $\pm$ 1.8) $\times 10^{-4}$	
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 5 $\times 10^{-4}$	90%
Γ_{11} $3\pi^+ 3\pi^-$	(7.0 $\pm$ 3.1) $\times 10^{-5}$	
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	(1.0 $\pm$ 0.4) $\times 10^{-3}$	
Γ_{13} $3\pi^+ 3\pi^- K^+ K^-$	< 8 $\times 10^{-5}$	90%
Γ_{14} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	(3.6 $\pm$ 1.5) $\times 10^{-4}$	
Γ_{15} $4\pi^+ 4\pi^-$	(8 $\pm$ 4) $\times 10^{-5}$	
Γ_{16} $4\pi^+ 4\pi^- 2\pi^0$	(1.8 $\pm$ 0.7) $\times 10^{-3}$	
Γ_{17} $J/\psi J/\psi$	< 4 $\times 10^{-5}$	90%
Γ_{18} $J/\psi \psi(2S)$	< 5 $\times 10^{-5}$	90%
Γ_{19} $\psi(2S) \psi(2S)$	< 1.6 $\times 10^{-5}$	90%
Γ_{20} $J/\psi(1S)$ anything	(1.5 $\pm$ 0.4) $\times 10^{-3}$	

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

DESIG=20

$\chi_{b2}(1P)$ BRANCHING RATIOS

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
0.180$\pm$0.010 OUR AVERAGE					
0.164 $^{+0.009}_{-0.010}$ $\pm$ 0.008	503k	¹ FULSOM	18 BELL	$\Upsilon(2S) \rightarrow \gamma X$	
0.185 $\pm$ 0.008 $\pm$ 0.009		^{2,3,4} LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$	
0.186 $\pm$ 0.011 $\pm$ 0.009	1770	^{4,5} KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$	
0.194 $^{+0.014}_{-0.017}$ $\pm$ 0.009	8k	⁶ LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$	
0.25 $\pm$ 0.06 $\pm$ 0.01	35	^{4,7,8} WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	
0.20 $\pm$ 0.05		KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$	

NODE=M078220

NODE=M078R1
NODE=M078R1

OCCUR=2

¹ FULSOM 18 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.17 \pm 0.01^{+0.06}_{-0.07}) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=H

² LEES 14M quotes $\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}} = (1.32 \pm 0.06)\%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M078R1;LINKAGE=B

³ LEES 14M reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.32 \pm 0.06) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=F

⁴ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M078R1;LINKAGE=KA

⁵ KORNICER 11 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (1.33 \pm 0.04 \pm 0.07) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=KR

⁶ LEES 11J reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (13.9 \pm 0.5^{+0.9}_{-1.1}) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=LE

⁷ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (4.4 \pm 0.9 \pm 0.5) \%$.

NODE=M078R1;LINKAGE=A

⁸ WALK 86 reports $[\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (17.7 \pm 3.6 \pm 2.0) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R1;LINKAGE=E

$\Gamma(D^0 X)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<7.9 $\times 10^{-2}$	90	^{1,2} BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$	

NODE=M078R01
NODE=M078R01

¹ For $p_{D^0} > 2.5$ GeV/c.

NODE=M078R01;LINKAGE=BR

² The authors also present their result as $(5.4 \pm 1.9 \pm 0.5) \times 10^{-2}$.

NODE=M078R01;LINKAGE=RI

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
0.84$\pm$0.50$\pm$0.04	8	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$	

NODE=M078R02
NODE=M078R02

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] = (6 \pm 3 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M078R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	
<1.0	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$	

NODE=M078R03
NODE=M078R03

¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] < 7 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

NODE=M078R03;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.3±2.4±0.3	11	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (38 \pm 14 \pm 10) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R04
 NODE=M078R04

NODE=M078R04;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5±1.4±0.2	19	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (25 \pm 8 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R05
 NODE=M078R05

NODE=M078R05;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.4±0.1	14	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (8 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R06
 NODE=M078R06

NODE=M078R06;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.9±0.1	13	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (15 \pm 5 \pm 4) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R07
 NODE=M078R07

NODE=M078R07;LINKAGE=AS

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.9±1.8±0.2	11	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (28 \pm 11 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R08
 NODE=M078R08

NODE=M078R08;LINKAGE=AS

 $\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] < 36 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R09
 NODE=M078R09

NODE=M078R09;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.31±0.03	9	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (5 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R10
 NODE=M078R10

NODE=M078R10;LINKAGE=AS

 $\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.2±3.6±0.5	34	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P))] = (73 \pm 16 \pm 20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R11
 NODE=M078R11

NODE=M078R11;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $< 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.				

NODE=M078R12
 NODE=M078R12

NODE=M078R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 1.5 \pm 0.2$	14	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (26 \pm 8 \pm 7) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R13
 NODE=M078R13

NODE=M078R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.40 \pm 0.04$	7	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (6 \pm 2 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R14
 NODE=M078R14

NODE=M078R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$18 \pm 7 \pm 1$	29	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
¹ ASNER 08A reports $[\Gamma(\chi_{b2}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ $= (132 \pm 31 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M078R15
 NODE=M078R15

NODE=M078R15;LINKAGE=AS

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
¹ SHEN 12 reports $< 4.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R16
 NODE=M078R16

NODE=M078R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
¹ SHEN 12 reports $< 4.9 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow J/\psi \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R17
 NODE=M078R17

NODE=M078R17;LINKAGE=SH

 $\Gamma(\psi(2S) \psi(2S))/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$
¹ SHEN 12 reports $< 1.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b2}(1P) \rightarrow \psi(2S) \psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = (7.15 \pm 0.35) \times 10^{-2}$.				

NODE=M078R18
 NODE=M078R18

NODE=M078R18;LINKAGE=SH

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.50 \pm 0.34 \pm 0.22$	462	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M078R00
 NODE=M078R00

 $\chi_{b2}(1P)$ Cross-Particle Branching Ratios

NODE=M078230

$$\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{72}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.9 \pm 0.5^{+0.9}_{-1.1}$	8k	LEES	11J BABR	$\Upsilon(2S) \rightarrow X \gamma$

NODE=M078B03
 NODE=M078B03

$$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.38±0.16 OUR AVERAGE				
$3.63^{+0.36+0.18}_{-0.34-0.19}$		¹ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$3.29 \pm 0.09 \pm 0.16$	1770	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$4.4 \pm 0.9 \pm 0.5$	35	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.

NODE=M078B01
NODE=M078B01

NODE=M078B01;LINKAGE=A

$$[B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
55.6±1.6	¹ LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

¹ From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ events without converted photons.

NODE=M078A00
NODE=M078A00

NODE=M078A00;LINKAGE=A

$$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.8 ±0.5 OUR AVERAGE				
$4.68^{+0.99}_{-0.92} \pm 0.37$		¹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$3.56 \pm 0.40 \pm 0.41$	126	KORNICER	11 CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with converted photons.

NODE=M078B02
NODE=M078B02

NODE=M078B02;LINKAGE=A

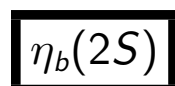
$\chi_{b2}(1P)$ REFERENCES

FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)
AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.)
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

NODE=M078

REFID=59535
REFID=58318
REFID=56199
REFID=56343
REFID=54313
REFID=16769
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=46612
REFID=40019
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286

NODE=M200



$$I^G(J^{PC}) = 0^+(0^-+)$$

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

NODE=M200

$\eta_b(2S)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
9999.0±3.5^{+2.8}_{-1.9}	26k	¹ MIZUK	12 BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- + \text{hadrons}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

9974.6±2.3±2.1 11 ± 4 ^{2,3,4} DOBBS 12 $\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.

² SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S) \gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.

³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

⁴ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass difference measurement.

NODE=M200M;LINKAGE=MI

NODE=M200M;LINKAGE=A

NODE=M200M;LINKAGE=DO

NODE=M200M;LINKAGE=NI

$$m_{\Upsilon(2S)} - m_{\eta_b(2S)}$$

NODE=M200DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$24.3 \pm 3.5^{+2.8}_{-1.9}$	26k	⁵ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$48.7 \pm 2.3 \pm 2.1$	11 ± 4	^{6,7,8} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
⁵ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass measurement.				
⁶ SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.				
⁷ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.				
⁸ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass measurement.				

$\eta_b(2S)$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons

$\eta_b(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	seen

$\eta_b(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$				Γ_1/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	26k	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		^{9,10} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons	
⁹ SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.					
¹⁰ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.					

$\eta_b(2S)$ REFERENCES

SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M200DM

NODE=M200DM;LINKAGE=MI

NODE=M200DM;LINKAGE=A

NODE=M200DM;LINKAGE=DO

NODE=M200DM;LINKAGE=NI

NODE=M200W

NODE=M200W

NODE=M200215;NODE=M200

DESIG=1

NODE=M200225

NODE=M200R01
NODE=M200R01

NODE=M200R01;LINKAGE=A

NODE=M200R01;LINKAGE=DO

NODE=M200

REFID=55590
REFID=54288
REFID=54718

$\Upsilon(2S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

NODE=M052

 $\Upsilon(2S)$ MASS

NODE=M052M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.4±0.5	¹ SHAMOV	23 RVUE	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10022.7±0.4	² SHAMOV	23 RVUE	$e^+e^- \rightarrow \text{hadrons}$
10023.5±0.5	^{3,4} ARTAMONOV	00 MD1	$e^+e^- \rightarrow \text{hadrons}$
10023.6±0.5	^{5,6} BARU	86B MD1	$e^+e^- \rightarrow \text{hadrons}$
10023.1±0.4	⁷ BARBER	84 ARG	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.			
² Obtained by reanalysing ARGUS and Crystal Ball data (BARBER 84), but not authored by the ARGUS and Crystal Ball collaboration.			
³ Reanalysis of BARU 86B using new electron mass (COHEN 87).			
⁴ Superseded by SHAMOV 23.			
⁵ Reanalysis of ARTAMONOV 84.			
⁶ Superseded by ARTAMONOV 00.			
⁷ Reanalysed by SHAMOV 23.			

NODE=M052M

OCCUR=2

NODE=M052M;LINKAGE=A

NODE=M052M;LINKAGE=B

NODE=M052M;LINKAGE=AR

NODE=M052M;LINKAGE=E

NODE=M052M;LINKAGE=C

NODE=M052M;LINKAGE=RZ

NODE=M052M;LINKAGE=D

 $m\Upsilon(3S) - m\Upsilon(2S)$

NODE=M052DM3

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M052DM3

 $\Upsilon(2S)$ WIDTH

NODE=M052W

VALUE (keV)	DOCUMENT ID
31.98±2.63 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M052W

→ UNCHECKED ←

 $\Upsilon(2S)$ DECAY MODES

NODE=M052215;NODE=M052

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
$\Gamma_1 \quad \Upsilon(1S)\pi^+\pi^-$	(17.85± 0.26) %		DESIG=4
$\Gamma_2 \quad \Upsilon(1S)\pi^0\pi^0$	(8.6 ± 0.4) %		DESIG=5
$\Gamma_3 \quad \tau^+\tau^-$	(2.00± 0.21) %		DESIG=3
$\Gamma_4 \quad \mu^+\mu^-$	(1.93± 0.17) %	S=2.2	DESIG=1
$\Gamma_5 \quad e^+e^-$	(1.91± 0.16) %		DESIG=2
$\Gamma_6 \quad \Upsilon(1S)\pi^0$	< 4 $\times 10^{-5}$	CL=90%	DESIG=10
$\Gamma_7 \quad \Upsilon(1S)\eta$	(2.9 ± 0.4) $\times 10^{-4}$	S=2.0	DESIG=6
$\Gamma_8 \quad J/\psi(1S) \text{ anything}$	< 6 $\times 10^{-3}$	CL=90%	DESIG=20
$\Gamma_9 \quad J/\psi(1S)\eta_c$	< 5.4 $\times 10^{-6}$	CL=90%	DESIG=143
$\Gamma_{10} \quad J/\psi(1S)\chi_{c0}$	< 3.4 $\times 10^{-6}$	CL=90%	DESIG=144
$\Gamma_{11} \quad J/\psi(1S)\chi_{c1}$	< 1.2 $\times 10^{-6}$	CL=90%	DESIG=145
$\Gamma_{12} \quad J/\psi(1S)\chi_{c2}$	< 2.0 $\times 10^{-6}$	CL=90%	DESIG=146
$\Gamma_{13} \quad J/\psi(1S)\eta_c(2S)$	< 2.5 $\times 10^{-6}$	CL=90%	DESIG=147
$\Gamma_{14} \quad J/\psi(1S)X(3940)$	< 2.0 $\times 10^{-6}$	CL=90%	DESIG=148
$\Gamma_{15} \quad J/\psi(1S)X(4160)$	< 2.0 $\times 10^{-6}$	CL=90%	DESIG=149
$\Gamma_{16} \quad \chi_{c1} \text{ anything}$	(2.2 ± 0.5) $\times 10^{-4}$		DESIG=157
$\Gamma_{17} \quad \chi_{c1}(1P)^0 X_{tetra}$	< 3.67 $\times 10^{-5}$	CL=90%	DESIG=160
$\Gamma_{18} \quad \chi_{c2} \text{ anything}$	(2.3 ± 0.8) $\times 10^{-4}$		DESIG=158
$\Gamma_{19} \quad \psi(2S)\eta_c$	< 5.1 $\times 10^{-6}$	CL=90%	DESIG=150
$\Gamma_{20} \quad \psi(2S)\chi_{c0}$	< 4.7 $\times 10^{-6}$	CL=90%	DESIG=151
$\Gamma_{21} \quad \psi(2S)\chi_{c1}$	< 2.5 $\times 10^{-6}$	CL=90%	DESIG=152
$\Gamma_{22} \quad \psi(2S)\chi_{c2}$	< 1.9 $\times 10^{-6}$	CL=90%	DESIG=153
$\Gamma_{23} \quad \psi(2S)\eta_c(2S)$	< 3.3 $\times 10^{-6}$	CL=90%	DESIG=154
$\Gamma_{24} \quad \psi(2S)X(3940)$	< 3.9 $\times 10^{-6}$	CL=90%	DESIG=155
$\Gamma_{25} \quad \psi(2S)X(4160)$	< 3.9 $\times 10^{-6}$	CL=90%	DESIG=156
$\Gamma_{26} \quad T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-$	< 1.0 $\times 10^{-6}$	CL=90%	DESIG=162

Г ₂₇	$T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-$	$< 1.67 \times 10^{-5}$	CL=90%	DESIG=163
Г ₂₈	$T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp$	$< 7.3 \times 10^{-6}$	CL=90%	DESIG=164
Г ₂₉	$T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-$	$< 1.35 \times 10^{-5}$	CL=90%	DESIG=165
Г ₃₀	$T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-$	$< 2.67 \times 10^{-5}$	CL=90%	DESIG=166
Г ₃₁	$T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp$	$< 2.72 \times 10^{-5}$	CL=90%	DESIG=167
Г ₃₂	$T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-$	$< 2.03 \times 10^{-5}$	CL=90%	DESIG=168
Г ₃₃	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp$	$< 1.11 \times 10^{-5}$	CL=90%	DESIG=170
Г ₃₄	$T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp$	$< 2.11 \times 10^{-5}$	CL=90%	DESIG=171
Г ₃₅	$\overline{2H}$ anything	$(2.78^{+0.30}_{-0.26}) \times 10^{-5}$	S=1.2	DESIG=16
Г ₃₆	hadrons	$(94 \pm 11) \%$		DESIG=101
Г ₃₇	$g g g$	$(58.8 \pm 1.2) \%$		DESIG=105
Г ₃₈	$\gamma g g$	$(1.87 \pm 0.28) \%$		DESIG=106
Г ₃₉	$\phi K^+ K^-$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=133
Г ₄₀	$\omega \pi^+ \pi^-$	$< 2.58 \times 10^{-6}$	CL=90%	DESIG=134
Г ₄₁	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(2.3 \pm 0.7) \times 10^{-6}$		DESIG=135
Г ₄₂	$\phi f'_2(1525)$	$< 1.33 \times 10^{-6}$	CL=90%	DESIG=136
Г ₄₃	$\omega f_2(1270)$	$< 5.7 \times 10^{-7}$	CL=90%	DESIG=137
Г ₄₄	$\rho(770) a_2(1320)$	$< 8.8 \times 10^{-7}$	CL=90%	DESIG=138
Г ₄₅	$K^*(892)^0 \overline{K}_2^*(1430)^0 + \text{c.c.}$	$(1.5 \pm 0.6) \times 10^{-6}$		DESIG=139
Г ₄₆	$K_1(1270)^\pm K^\mp$	$< 3.22 \times 10^{-6}$	CL=90%	DESIG=140
Г ₄₇	$K_1(1400)^\pm K^\mp$	$< 8.3 \times 10^{-7}$	CL=90%	DESIG=141
Г ₄₈	$b_1(1235)^\pm \pi^\mp$	$< 4.0 \times 10^{-7}$	CL=90%	DESIG=142
Г ₄₉	$\rho \pi$	$< 1.16 \times 10^{-6}$	CL=90%	DESIG=126
Г ₅₀	$\pi^+ \pi^- \pi^0$	$< 8.0 \times 10^{-7}$	CL=90%	DESIG=127
Г ₅₁	$\omega \pi^0$	$< 1.63 \times 10^{-6}$	CL=90%	DESIG=128
Г ₅₂	$\pi^+ \pi^- \pi^0 \pi^0$	$(1.30 \pm 0.28) \times 10^{-5}$		DESIG=129
Г ₅₃	$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.14 \pm 0.33) \times 10^{-6}$		DESIG=130
Г ₅₄	$K^*(892)^0 \overline{K}^0 + \text{c.c.}$	$< 4.22 \times 10^{-6}$	CL=90%	DESIG=131
Г ₅₅	$K^*(892)^- K^+ + \text{c.c.}$	$< 1.45 \times 10^{-6}$	CL=90%	DESIG=132
Г ₅₆	$f_1(1285) \text{ anything}$	$(2.2 \pm 1.6) \times 10^{-3}$		DESIG=159
Г ₅₇	$f_1(1285) X_{tetra}$	$< 6.47 \times 10^{-5}$	CL=90%	DESIG=161
Г ₅₈	$D_s^+ D_{s1}(2536)^-$			DESIG=177
Г ₅₉	$D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0$	$(1.6 \pm 0.4) \times 10^{-5}$		DESIG=178
Г ₆₀	$D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-$	$(8.4 \pm 2.3) \times 10^{-6}$		DESIG=179
Г ₆₁	$D_s^{*+} D_{s1}(2536)^-$			DESIG=180
Г ₆₂	$D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0$	$(1.4 \pm 0.4) \times 10^{-5}$		DESIG=181
Г ₆₃	$D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-$	$(8.2 \pm 3.1) \times 10^{-6}$		DESIG=182
Г ₆₄	$D_s^+ D_{s2}^*(2573)^-$			DESIG=183
Г ₆₅	$D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0$	$(1.4 \pm 0.4) \times 10^{-5}$		DESIG=184
Г ₆₆	$D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-$	$(6.9 \pm 3.0) \times 10^{-6}$		DESIG=185
Г ₆₇	$D_s^{*+} D_{s2}^*(2573)^-$			DESIG=186
Г ₆₈	$D_s^{*+} D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0$	$(9 \pm 5) \times 10^{-6}$		DESIG=187
Г ₆₉	$D_s^{*+} D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-$	$(5 \pm 6) \times 10^{-6}$		DESIG=188
Г ₇₀	Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$		DESIG=121

Radiative decays

Γ_{71}	$\gamma\chi_{b1}(1P)$	(6.9 $\pm$ 0.4) %			NODE=M052;CLUMP=A
Γ_{72}	$\gamma\chi_{b2}(1P)$	(7.15 $\pm$ 0.35) %			DESIG=8
Γ_{73}	$\gamma\chi_{b0}(1P)$	(3.8 $\pm$ 0.4) %			DESIG=7
Γ_{74}	$\gamma f_0(1710)$	< 5.9	$\times 10^{-4}$	CL=90%	DESIG=9
Γ_{75}	$\gamma f'_2(1525)$	< 5.3	$\times 10^{-4}$	CL=90%	DESIG=13
Γ_{76}	$\gamma f_2(1270)$	< 2.41	$\times 10^{-4}$	CL=90%	DESIG=12
Γ_{77}	$\gamma f_J(2220)$				DESIG=11
Γ_{78}	$\gamma\eta_c(1S)$	< 2.7	$\times 10^{-5}$	CL=90%	DESIG=14
Γ_{79}	$\gamma\chi_{c0}$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=111
Γ_{80}	$\gamma\chi_{c1}$	< 3.6	$\times 10^{-6}$	CL=90%	DESIG=112
Γ_{81}	$\gamma\chi_{c2}$	< 1.5	$\times 10^{-5}$	CL=90%	DESIG=113
Γ_{82}	$\gamma\chi_{c1}(3872)$	< 2.3	$\times 10^{-5}$	CL=90%	DESIG=114
Γ_{83}	$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.4	$\times 10^{-6}$	CL=90%	DESIG=172
Γ_{84}	$\gamma\chi_{c0}(3915) \rightarrow \omega J/\psi$	< 2.8	$\times 10^{-6}$	CL=90%	DESIG=116
Γ_{85}	$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 1.2	$\times 10^{-6}$	CL=90%	DESIG=117
Γ_{86}	$\gamma X(4350) \rightarrow \phi J/\psi$	< 1.3	$\times 10^{-6}$	CL=90%	DESIG=118
Γ_{87}	$\gamma\eta_b(1S)$	(5.5 $\pm$ 1.1 $\pm$ 0.9) $\times 10^{-4}$		S=1.2	DESIG=119
Γ_{88}	$\gamma\eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	< 3.7	$\times 10^{-6}$	CL=90%	DESIG=102
Γ_{89}	$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	< 4.9	$\times 10^{-6}$	CL=90%	DESIG=124
Γ_{90}	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] < 1.95	$\times 10^{-4}$	CL=95%	DESIG=125
Γ_{91}	$\gamma A^0 \rightarrow \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%	DESIG=103
Γ_{92}	$\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	< 8.3	$\times 10^{-6}$	CL=90%	DESIG=107

Lepton Family number (LF) violating modes

Γ_{93}	$e^\pm \tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%	NODE=M052;CLUMP=B
Γ_{94}	$\mu^\pm \tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%	DESIG=104

[a] 1.5 GeV < m_X < 5.0 GeV

LINKAGE=C52

FIT INFORMATION

An overall fit to 3 branching ratios uses 13 measurements to determine 2 parameters. The overall fit has a $\chi^2 = 11.8$ for 11 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

$$x_7 \begin{vmatrix} & 2 \\ & x_1 \end{vmatrix}$$

 $\Gamma(2S) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M052218

$\Gamma(\mu^+ \mu^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_4 \Gamma_5 / \Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
6.5 $\pm$ 1.5 $\pm$ 1.0	KOBEL 92 CBAL $e^+ e^- \rightarrow \mu^+ \mu^-$

NODE=M052G1
NODE=M052G1

$\Gamma(\Gamma(1S)\pi^+\pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_1 \Gamma_5 / \Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	
105.4 $\pm$ 1.0 $\pm$ 4.2	11.8k ¹ AUBERT 08BP BABR 10.58 $e^+ e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

NODE=M052G03
NODE=M052G03

¹ Using $B(\Gamma(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\Gamma(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M052G03;LINKAGE=AU

$\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{36}\Gamma_5/\Gamma$

VALUE (keV)

DOCUMENT ID

TECN

COMMENT

0.577±0.009 OUR AVERAGE

0.581±0.004±0.009	¹ ROSNER	06	CLEO	10.0 $e^+e^- \rightarrow \text{hadrons}$
0.552±0.031±0.017	¹ BARU	96	MD1	$e^+e^- \rightarrow \text{hadrons}$
0.54 ±0.04 ±0.02	¹ JAKUBOWSKI	88	CBAL	$e^+e^- \rightarrow \text{hadrons}$
0.58 ±0.03 ±0.04	² GILES	84B	CLEO	$e^+e^- \rightarrow \text{hadrons}$
0.60 ±0.12 ±0.07	² ALBRECHT	82	DASP	$e^+e^- \rightarrow \text{hadrons}$
0.54 ±0.07 ^{+0.09} _{-0.05}	² NICZYPORUK	81C	LENA	$e^+e^- \rightarrow \text{hadrons}$
0.41 ±0.18	² BOCK	80	CNTR	$e^+e^- \rightarrow \text{hadrons}$

¹ Radiative corrections evaluated following KURAEV 85.² Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.NODE=M052G2
NODE=M052G2NODE=M052G2;LINKAGE=P
NODE=M052G2;LINKAGE=R $\Upsilon(2S)$ PARTIAL WIDTHS

NODE=M052220

 $\Gamma(e^+e^-)$ Γ_5

VALUE (keV)

DOCUMENT ID

0.612±0.011 OUR EVALUATIONNODE=M052W2
NODE=M052W2
→ UNCHECKED ← $\Upsilon(2S)$ BRANCHING RATIOS

NODE=M052225

 $\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_1/Γ

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

17.85±0.26 OUR FIT**17.92±0.26 OUR AVERAGE**

16.8 ±1.1 ±1.3	906k	¹ LEES	11C	BABR	$e^+e^- \rightarrow \pi^+\pi^- X$
17.80±0.05±0.37	170k	² LEES	11L	BABR	$\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
18.02±0.02±0.61	851k	³ BHARI	09	CLEO	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
17.22±0.17±0.75	11.8k	⁴ AUBERT	08BP	BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
19.2 ±0.2 ±1.0	52.6k	⁵ ALEXANDER	98	CLE2	$\pi^+\pi^-\ell^+\ell^-, \pi^+\pi^- \text{MM}$
18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
16.9 ±4.0		GELPHMAN	85	CBAL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
19.1 ±1.2 ±0.6		BESSON	84	CLEO	$\pi^+\pi^- \text{MM}$
18.9 ±2.6		FONSECA	84	CUSB	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$
21 ±7	7	NICZYPORUK	81B	LENA	$e^+e^- \rightarrow \ell^+\ell^-\pi^+\pi^-$

¹ LEES 11c reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything})] = (1.78 \pm 0.02 \pm 0.11) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \Upsilon(2S)\text{anything}) = (10.6 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.³ A weighted average of the inclusive and exclusive results.⁴ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$ and, $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.⁵ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.

NODE=M052R4

NODE=M052R4
NODE=M052R4

NODE=M052R4;LINKAGE=ES

NODE=M052R4;LINKAGE=LE
NODE=M052R4;LINKAGE=BH
NODE=M052R4;LINKAGE=AU

NODE=M052R4;LINKAGE=T

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_2/Γ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

8.6 ±0.4 OUR AVERAGE

8.43±0.16±0.42	38k	¹ BHARI	09	CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.2 ±0.6 ±0.8	275	² ALEXANDER	98	CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
9.5 ±1.9 ±1.9	25	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
8.0 ±1.5		GELPHMAN	85	CBAL	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
10.3 ±2.3		FONSECA	84	CUSB	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

¹ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.52 \pm 0.17)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.07)\%$.NODE=M052R5
NODE=M052R5NODE=M052R5;LINKAGE=BH
NODE=M052R5;LINKAGE=T $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_1

VALUE

DOCUMENT ID

TECN

COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.462±0.037	¹ BHARI	09	CLEO	$e^+e^- \rightarrow \Upsilon(2S)$

¹ Not independent of other values reported by BHARI 09.NODE=M052R21
NODE=M052R21

NODE=M052R21;LINKAGE=BH

$\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

2.00±0.21 OUR AVERAGE

2.00±0.12±0.18	22k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(2S) \rightarrow \tau^+\tau^-$
1.7 ±1.5 ±0.6		HAAS	84B	CLEO $e^+e^- \rightarrow \tau^+\tau^-$

¹ BESSON 07 reports $[\Gamma(\Upsilon(2S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \mu^+\mu^-)] = 1.04 \pm 0.04 \pm 0.05$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M052R3
NODE=M052R3

NODE=M052R3;LINKAGE=BE

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.0193±0.0017 OUR AVERAGE Error includes scale factor of 2.2. See the ideogram below.

0.0203±0.0003±0.0008	120k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0122±0.0028±0.0019		¹ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
0.0138±0.0025±0.0015		KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
0.009 ±0.006 ±0.006		² ALBRECHT	85	ARG $e^+e^- \rightarrow \mu^+\mu^-$
0.018 ±0.008 ±0.005		HAAS	84B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

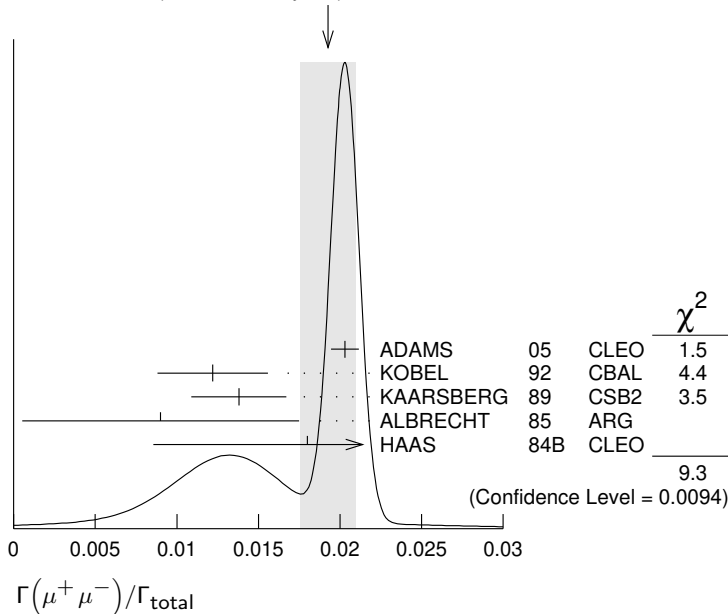
<0.038	90	NICZYPORUK	81C	LENA $e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.² Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.

NODE=M052R1
NODE=M052R1

NODE=M052R1;LINKAGE=A
NODE=M052R1;LINKAGE=R

WEIGHTED AVERAGE
0.0193±0.0017 (Error scaled by 2.2)

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_3/Γ_4

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

1.04±0.04±0.05 22k BESSON 07 CLEO $e^+e^- \rightarrow \Upsilon(2S)$

NODE=M052R17
NODE=M052R17

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 4	90	¹ TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$
< 18	90	² HE	08A	CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
< 110	90	ALEXANDER	98	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
< 800	90	LURZ	87	CBAL $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] < 2.3 \times 10^{-4}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10
NODE=M052R10

NODE=M052R10;LINKAGE=TA

NODE=M052R10;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_6/Γ_1

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R09
 NODE=M052R09

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

2.9 $\pm$ 0.4 OUR FIT Error includes scale factor of 2.0.

2.9 $\pm$ 0.4 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

2.39 $\pm$ 0.31 $\pm$ 0.14 112 ¹ LEES 11L BABR $\Upsilon(2S) \rightarrow \ell^+\ell^-\eta$

2.1 $\pm$ 0.7 $\pm$ 0.3 14 ² HE 08A CLEO $e^+e^- \rightarrow \ell^+\ell^-\eta$

• • • We use the following data for averages but not for fits. • • •

3.55 $\pm$ 0.32 $\pm$ 0.05 241 ³ TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\eta$

NOTFITTED

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 9 90 ^{1,4} AUBERT 08BP BABR $e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

< 28 90 ALEXANDER98 CLE2 $e^+e^- \rightarrow \ell^+\ell^-\eta$

< 50 90 ALBRECHT 87 ARG $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$ MM

< 70 90 LURZ 87 CBAL $e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, 3\pi^0)$

< 100 90 BESSON 84 CLEO $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$ MM

< 20 90 FONSECA 84 CUSB $e^+e^- \rightarrow \ell^+\ell^-(\gamma\gamma, \pi^+\pi^-\pi^0)$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

³ TAMPONI 13 reports $[\Gamma(\Upsilon(2S) \rightarrow \Upsilon(1S)\eta)/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)] = (1.99 \pm 0.14 \pm 0.11) \times 10^{-3}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (17.85 \pm 0.26) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

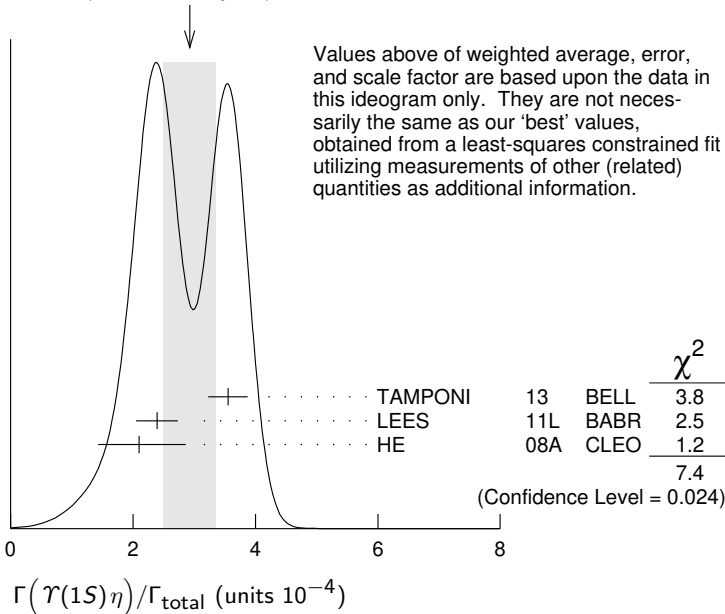
NODE=M052R6;LINKAGE=AU

NODE=M052R6;LINKAGE=HE

NODE=M052R6;LINKAGE=TA

NODE=M052R6;LINKAGE=UB

WEIGHTED AVERAGE
 2.9 $\pm$ 0.4 (Error scaled by 1.9)

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_7/Γ_1

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.64 $\pm$ 0.25 OUR FIT Error includes scale factor of 2.0.

1.99 $\pm$ 0.14 $\pm$ 0.11 241 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.35 $\pm$ 0.17 $\pm$ 0.08 ¹ LEES 11L BABR $\Upsilon(2S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\mu^+\mu^-$

< 5.2 90 ² AUBERT 08BP BABR $e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

¹ Not independent of other values reported by LEES 11L.

² Not independent of other values reported by AUBERT 08BP.

NODE=M052R22
 NODE=M052R22

NODE=M052R22;LINKAGE=LE

NODE=M052R22;LINKAGE=AU

$$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\eta)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.13	90	TAMPONI	13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0$

 Γ_6/Γ_7

NODE=M052R23
NODE=M052R23

$$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.006	90	MASCHMANN	90	CBAL	$e^+e^- \rightarrow \text{hadrons}$

 Γ_8/Γ

NODE=M052R16
NODE=M052R16

$$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.4 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_9/Γ

NODE=M052R53
NODE=M052R53

$$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.4 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{10}/Γ

NODE=M052R54
NODE=M052R54

$$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{11}/Γ

NODE=M052R55
NODE=M052R55

$$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.0 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{12}/Γ

NODE=M052R56
NODE=M052R56

$$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.5 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{13}/Γ

NODE=M052R57
NODE=M052R57

$$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.0 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{14}/Γ

NODE=M052R58
NODE=M052R58

$$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.0 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$

 Γ_{15}/Γ

NODE=M052R59
NODE=M052R59

$$\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT

2.24 ± 0.44 ± 0.20	376	JIA	17	BELL	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$

 Γ_{16}/Γ

NODE=M052R00
NODE=M052R00

$$\Gamma(\chi_{c1}(1P)^0 X_{\text{tetra}})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<36.7 × 10 ⁻⁶	90	¹ JIA	17A	BELL	$e^+e^- \rightarrow \text{hadrons}$

 Γ_{17}/Γ

NODE=M052R69
NODE=M052R69

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 4.4×10^{-6} to 36.7×10^{-6} .

NODE=M052R69;LINKAGE=A

$$\Gamma(\chi_{c2} \text{ anything})/\Gamma_{\text{total}}$$

VALUE (units 10 ⁻⁴)	DOCUMENT ID	TECN	COMMENT

2.28 ± 0.73 ± 0.34	JIA	17	BELL	$\Upsilon(2S) \rightarrow \gamma J/\psi(1S)$

 Γ_{18}/Γ

NODE=M052R67
NODE=M052R67

$$\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.1 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$

 Γ_{19}/Γ

NODE=M052R60
NODE=M052R60

$$\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<4.7 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$

 Γ_{20}/Γ

NODE=M052R61
NODE=M052R61

$$\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.5 × 10 ⁻⁶	90	YANG	14	BELL	$e^+e^- \rightarrow \psi(2S)X$

 Γ_{21}/Γ

NODE=M052R62
NODE=M052R62

$\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.9 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S)X$

NODE=M052R63
NODE=M052R63

$\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.3 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S)X$

NODE=M052R64
NODE=M052R64

$\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.9 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S)X$

NODE=M052R65
NODE=M052R65

$\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.9 \times 10^{-6}$	90	YANG	14	BELL $e^+e^- \rightarrow \psi(2S)X$

NODE=M052R66
NODE=M052R66

$\Gamma(T_{c\bar{c}1}(3900)^+ T_{c\bar{c}1}(3900)^-)/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow J/\psi \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm) = 1$.

NODE=M052R71
NODE=M052R71

NODE=M052R71;LINKAGE=A

$\Gamma(T_{c\bar{c}1}(4200)^+ T_{c\bar{c}1}(4200)^-)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<16.7 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1$

NODE=M052R72
NODE=M052R72

NODE=M052R72;LINKAGE=A

$\Gamma(T_{c\bar{c}1}(3900)^\pm T_{c\bar{c}1}(4200)^\mp)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.3 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow J/\psi \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}1}(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1 = B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi \pi^\pm)$.

NODE=M052R73
NODE=M052R73

NODE=M052R73;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4050)^+ T_{c\bar{c}}(4050)^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<13.5 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm)$

NODE=M052R74
NODE=M052R74

NODE=M052R74;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4250)^+ T_{c\bar{c}}(4250)^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<26.7 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm) = 1$

NODE=M052R75
NODE=M052R75

NODE=M052R75;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4050)^\pm T_{c\bar{c}}(4250)^\mp)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<27.2 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \chi_{c1}(1P) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4050)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm) = 1 = B(T_{c\bar{c}}(4250)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm)$

NODE=M052R76
NODE=M052R76

NODE=M052R76;LINKAGE=A

$\Gamma(T_{c\bar{c}1}(4430)^+ T_{c\bar{c}1}(4430)^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<20.3 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2P) \pi^\pm) = 1$

NODE=M052R77
NODE=M052R77

NODE=M052R77;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}}(4055)^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<11.1 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S) \pi^\pm) = 1$

NODE=M052R79
NODE=M052R79

NODE=M052R79;LINKAGE=A

$\Gamma(T_{c\bar{c}}(4055)^\pm T_{c\bar{c}1}(4430)^\mp)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<21.1 \times 10^{-6}$	90	1 JIA	18	BELL $\Upsilon(2S) \rightarrow \psi(2S) \pi^\pm X$

¹ Assuming $B(T_{c\bar{c}}(4055)^\pm \rightarrow \psi(2S) \pi^\pm) = 1 = B(T_{c\bar{c}1}(4430)^\pm \rightarrow \psi(2S) \pi^\pm)$

NODE=M052R80
NODE=M052R80

NODE=M052R80;LINKAGE=A

$\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R18
NODE=M052R18

2.78^{+0.30}_{-0.26} OUR AVERAGE Error includes scale factor of 1.2.

2.64 $\pm$ 0.11 ^{+0.26} _{-0.21}		LEES	14G	BABR	$e^+e^- \rightarrow \overline{2H} X$
3.37 $\pm$ 0.50 $\pm$ 0.25	58	ASNER	07	CLEO	$e^+e^- \rightarrow \overline{2H} X$

 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R01
NODE=M052R01

58.8 $\pm$ 1.2 6M ¹ BESSON 06A CLEO $\Upsilon(2S) \rightarrow \text{hadrons}$

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ from BESSON 06A and PDG 08 values of $B(\pi^+\pi^-\Upsilon(1S)) = (18.1 \pm 0.4)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (8.6 \pm 0.4)\%$, $B(\mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$ Γ_{38}/Γ_{37}

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R03
NODE=M052R03

3.18 $\pm$ 0.04 $\pm$ 0.47 6M BESSON 06A CLEO $\Upsilon(2S) \rightarrow (\gamma +) \text{ hadrons}$

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R43
NODE=M052R43

1.58 $\pm$ 0.33 $\pm$ 0.18 58 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(K^+ K^-)$

 $\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R44
NODE=M052R44

<2.58 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R45
NODE=M052R45

2.32 $\pm$ 0.40 $\pm$ 0.54 135 SHEN 12A BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R46
NODE=M052R46

<1.33 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(K^+ K^-)$

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R47
NODE=M052R47

<0.57 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R48
NODE=M052R48

<0.88 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(K^*(892)^0 \overline{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M052R49
NODE=M052R49

1.53 $\pm$ 0.52 $\pm$ 0.19 32 SHEN 12A BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R50
NODE=M052R50

<3.22 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R51
NODE=M052R51

<0.83 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R52
NODE=M052R52

<0.40 90 SHEN 12A BELL $\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M052R27
NODE=M052R27

<1.16 90 SHEN 13 BELL $\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{50}/\Gamma$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.80	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\pi^0$

NODE=M052R28
NODE=M052R28

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{51}/\Gamma$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M052R29
NODE=M052R29

 $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{52}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.0 \pm 1.9 \pm 2.1$	261 ± 37	SHEN	13	BELL $\Upsilon(2S) \rightarrow \pi^+\pi^-\pi^0\pi^0$

NODE=M052R30
NODE=M052R30

 $\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{53}/\Gamma$

<i>VALUE</i> (units 10^{-6})	<i>CL%</i>	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
1.14±0.30±0.13	40 ± 10	SHEN	13	BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R40
NODE=M052R40

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.2	90	¹ DOBBS	12A	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R40;LINKAGE=DO

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{54}/\Gamma$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.22	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R41
NODE=M052R41

 $\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{55}/\Gamma$

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.45	90	SHEN	13	BELL $\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

NODE=M052R42
NODE=M052R42

 $\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{56}/\Gamma$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.20 \pm 1.50 \pm 0.63$	2.9k	JIA	17A	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M052R68
NODE=M052R68

 $\Gamma(f_1(1285) X_{\text{tetra}})/\Gamma_{\text{total}} \quad \Gamma_{57}/\Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<64.7 $\times 10^{-6}$	90	¹ JIA	17A	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M052R70
NODE=M052R70

¹ For a tetraquark state X_{tetra} , with mass in the range 1.16–2.46 GeV and width in the range 0–0.3 GeV. Measured 90% CL limits as a function of X_{tetra} mass and width range from 7.8×10^{-6} to 64.7×10^{-6} .

NODE=M052R70;LINKAGE=A

 $\Gamma(D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0)/\Gamma_{\text{total}} \quad \Gamma_{59}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.6 \pm 0.3 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R86
NODE=M052R86

 $\Gamma(D_s^+ D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-)/\Gamma_{\text{total}} \quad \Gamma_{60}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.18 \pm 0.15$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R87
NODE=M052R87

 $\Gamma(D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K^- D^*(2007)^0)/\Gamma_{\text{total}} \quad \Gamma_{62}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.4 \pm 0.4 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R88
NODE=M052R88

 $\Gamma(D_s^{*+} D_{s1}(2536)^-, D_{s1}^- \rightarrow K_S^0 D^*(2010)^-)/\Gamma_{\text{total}} \quad \Gamma_{63}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.82 \pm 0.25 \pm 0.19$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R89
NODE=M052R89

 $\Gamma(D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0)/\Gamma_{\text{total}} \quad \Gamma_{65}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$1.4 \pm 0.4 \pm 0.2$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R90
NODE=M052R90

 $\Gamma(D_s^+ D_{s2}^*(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-)/\Gamma_{\text{total}} \quad \Gamma_{66}/\Gamma$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.69 \pm 0.20 \pm 0.22$	GAO	23	BELL e^+e^- at 10.52 GeV

NODE=M052R91
NODE=M052R91

$$\Gamma(D_s^{*+} D_{s2}^{*-}(2573)^-, D_{s2}^{*-} \rightarrow K^- D^0)/\Gamma_{\text{total}} \quad \Gamma_{68}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.9 \pm 0.5 \pm 0.2$	GAO	23	BELL $e^+ e^-$ at 10.52 GeV

NODE=M052R92
NODE=M052R92

$$\Gamma(D_s^{*+} D_{s2}^{*-}(2573)^-, D_{s2}^{*-} \rightarrow K_S^0 D^-)/\Gamma_{\text{total}} \quad \Gamma_{69}/\Gamma$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$0.54 \pm 0.31 \pm 0.47$	GAO	23	BELL $e^+ e^-$ at 10.52 GeV

NODE=M052R93
NODE=M052R93

$$\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}} \quad \Gamma_{70}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
0.29 ± 0.03	1,2 DOBBS	12A	$\Upsilon(2S) \rightarrow \text{hadrons}$

NODE=M052R08
NODE=M052R08

¹ DOBBS 12A presents individual exclusive branching fractions or upper limits for 100 modes of four to ten pions, kaons, or protons.

NODE=M052R08;LINKAGE=DO

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R08;LINKAGE=NC

$$\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}} \quad \Gamma_{71}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.069 ± 0.004 OUR AVERAGE				
$0.0693 \pm 0.0012 \pm 0.0041$	407k	ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$
$0.069 \pm 0.005 \pm 0.009$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$0.091 \pm 0.018 \pm 0.022$		ALBRECHT	85E	ARG $e^+ e^- \rightarrow \gamma \text{conv. } X$
$0.065 \pm 0.007 \pm 0.012$		NERNST	85	CBAL $e^+ e^- \rightarrow \gamma X$
$0.080 \pm 0.017 \pm 0.016$		HAAS	84	CLEO $e^+ e^- \rightarrow \gamma \text{conv. } X$
0.059 ± 0.014		KLOPFEN...	83	CUSB $e^+ e^- \rightarrow \gamma X$

NODE=M052R8
NODE=M052R8

$$\Gamma(\gamma \chi_{b2}(1P))/\Gamma_{\text{total}} \quad \Gamma_{72}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0715 ± 0.0035 OUR AVERAGE				
$0.0724 \pm 0.0011 \pm 0.0040$	410k	ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$
$0.074 \pm 0.005 \pm 0.008$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$0.098 \pm 0.021 \pm 0.024$		ALBRECHT	85E	ARG $e^+ e^- \rightarrow \gamma \text{conv. } X$
$0.058 \pm 0.007 \pm 0.010$		NERNST	85	CBAL $e^+ e^- \rightarrow \gamma X$
$0.102 \pm 0.018 \pm 0.021$		HAAS	84	CLEO $e^+ e^- \rightarrow \gamma \text{conv. } X$
0.061 ± 0.014		KLOPFEN...	83	CUSB $e^+ e^- \rightarrow \gamma X$

NODE=M052R7
NODE=M052R7

$$\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}} \quad \Gamma_{73}/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.038 ± 0.004 OUR AVERAGE				
$0.0375 \pm 0.0012 \pm 0.0047$	198k	ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$
$0.034 \pm 0.005 \pm 0.006$		EDWARDS	99	CLE2 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$
$0.064 \pm 0.014 \pm 0.016$		ALBRECHT	85E	ARG $e^+ e^- \rightarrow \gamma \text{conv. } X$
$0.036 \pm 0.008 \pm 0.009$		NERNST	85	CBAL $e^+ e^- \rightarrow \gamma X$
$0.044 \pm 0.023 \pm 0.009$		HAAS	84	CLEO $e^+ e^- \rightarrow \gamma \text{conv. } X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.035 ± 0.014		KLOPFEN...	83	CUSB $e^+ e^- \rightarrow \gamma X$

NODE=M052R9
NODE=M052R9

$$\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}} \quad \Gamma_{74}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<59	90	¹ ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma K^+ K^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 5.9	90	² ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M052R13
NODE=M052R13

¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.

OCCUR=2

² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.

NODE=M052R13;LINKAGE=M
NODE=M052R13;LINKAGE=N

$$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}} \quad \Gamma_{75}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<53	90	¹ ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma K^+ K^-$

NODE=M052R12
NODE=M052R12

¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.

NODE=M052R12;LINKAGE=L

$$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}} \quad \Gamma_{76}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24.1	90	¹ ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

NODE=M052R11
NODE=M052R11

¹ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.

NODE=M052R11;LINKAGE=K

$\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6.8	90	¹ ALBRECHT	89	ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

¹ Includes unknown branching ratio of $f_J(2220) \rightarrow K^+ K^-$.NODE=M052R14
NODE=M052R14

NODE=M052R14;LINKAGE=S

 $\Gamma(\gamma \eta_c(1S))/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.7 $\times 10^{-5}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R31
NODE=M052R31 $\Gamma(\gamma \chi_{c0})/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.0 $\times 10^{-4}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R32
NODE=M052R32 $\Gamma(\gamma \chi_{c1})/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.6 $\times 10^{-6}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R33
NODE=M052R33 $\Gamma(\gamma \chi_{c2})/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.5 $\times 10^{-5}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R34
NODE=M052R34 $\Gamma(\gamma \chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.3 $\times 10^{-5}$ (CL = 90%)		[<2.1 $\times 10^{-5}$ (CL = 90%) OUR 2023 BEST LIMIT]			

<2.3 $\times 10^{-5}$	90	¹ WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

¹ WANG 11B reports $[\Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{c1}(3872))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S))] < 0.8 \times 10^{-6}$ which we divide by our best value $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) = 3.5 \times 10^{-2}$.NODE=M052R81
NODE=M052R81

NODE=M052R81;LINKAGE=A

 $\Gamma(\gamma \chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+ \pi^- \pi^0 J/\psi)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.4 $\times 10^{-6}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R36
NODE=M052R36 $\Gamma(\gamma \chi_{c0}(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.8 $\times 10^{-6}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R37
NODE=M052R37 $\Gamma(\gamma \chi_{c1}(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 $\times 10^{-6}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R38
NODE=M052R38 $\Gamma(\gamma X(4350) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.3 $\times 10^{-6}$	90	WANG	11B	BELL	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R39
NODE=M052R39 $\Gamma(\gamma \eta_b(1S))/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

5.5^{+1.1}_{-0.9} OUR AVERAGE Error includes scale factor of 1.2.

6.1 ^{+0.6+0.9} _{-0.7-0.6}	29k	FULSOM	18	BELL	$\Upsilon(2S) \rightarrow \gamma X$

3.9 $\pm$ 1.1 ^{+1.1} _{-0.9}	13 $\pm$ 5k	¹ AUBERT	09AQ	BABR	$\Upsilon(2S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<21	90	LEES	11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$

< 8.4	90	¹ BONVICINI	10	CLEO	$\Upsilon(2S) \rightarrow \gamma X$

< 5.1	90	² ARTUSO	05	CLEO	$e^+ e^- \rightarrow \gamma X$

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV.² Superseded by BONVICINI 10.NODE=M052R15
NODE=M052R15NODE=M052R15;LINKAGE=BO
NODE=M052R15;LINKAGE=SU $\Gamma(\gamma \eta_b(1S) \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.7 $\times 10^{-6}$	90	SANDILYA	13	BELL	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M052R25
NODE=M052R25

$\Gamma(\gamma X_{b\bar{b}} \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$
 Γ_{89}/Γ

VALUE (units 10^{-6})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
< 4.9	90		SANDILYA	13 BELL	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$46.2^{+29.7}_{-14.2} \pm 10.6$	10		¹ DOBBS	12	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R26
NODE=M052R26

NODE=M052R26;LINKAGE=DO

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$
 Γ_{90}/Γ

(1.5 GeV < m_X < 5.0 GeV)

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.95	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M052R19

NODE=M052R19
NODE=M052R19

 $\Gamma(\gamma A^0 \rightarrow \gamma \text{ hadrons})/\Gamma_{\text{total}}$
 Γ_{91}/Γ

(0.3 GeV < m_{A^0} < 7 GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 8×10^{-5}	90	¹ LEES	11H BABR	$\Upsilon(2S) \rightarrow \gamma \text{ hadrons}$

¹ For a narrow scalar or pseudoscalar, A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M052R06

NODE=M052R06
NODE=M052R06

NODE=M052R06;LINKAGE=LE

 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$
 Γ_{92}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	¹ AUBERT	09Z BABR	$e^+e^- \rightarrow A^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar, A^0 , with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} range from $0.26\text{--}8.3 \times 10^{-6}$.

NODE=M052R24
NODE=M052R24

NODE=M052R24;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M052230

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$
 Γ_{93}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

NODE=M052R04
NODE=M052R04

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$
 Γ_{94}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.3	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<14.4	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M052R20
NODE=M052R20

$\Upsilon(2S)$ Cross-Particle Branching Ratios

NODE=M052240

 $B(\Upsilon(2S) \rightarrow \pi^+ \pi^-) \times B(\Upsilon(3S) \rightarrow \Upsilon(2S) X)$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.78 \pm 0.02 \pm 0.11$	906k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+ \pi^- X$

NODE=M052R05
NODE=M052R05

$\Upsilon(2S)$ REFERENCES

NODE=M052

GAO	23	PR D108 112015	B.S. Gao <i>et al.</i>	(BELLE Collab.)	REFID=62519
SHAMOV	23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
FULSOM	18	PRL 121 232001	B.G. Fulsom <i>et al.</i>	(BELLE Collab.)	REFID=59535
JIA	18	PR D97 112004	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58949
JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=57635
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)	REFID=58318
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)	REFID=56345
SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)	REFID=55590
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55395
TAMPONI	13	PR D87 011104	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=54919
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>		REFID=54288
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>		REFID=54746
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=54314
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
WANG	11B	PR D84 071107	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=53939
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662

AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
BESSION	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUEL...	88	HE e ⁺ e ⁻ Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding, World Scientific, Singapore				
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.) IGJPC
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)
BARU	86B	ZPHY C32 622 (errat.)	S.E. Baru <i>et al.</i>	(NOVO)
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
Translated from YAF 41 733.				
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>	
BESSION	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)

REFID=52660
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REFID=22264

$\gamma_2(1D)$

$$I^G(J^{PC}) = 0^-(2^--)$$

was $\gamma(1D)$

First observed by BONVICINI 04 in the decay to $\gamma\gamma \gamma(1S)$ and confirmed by DEL-AMO-SANCHEZ 10R in the decay to $\pi^+\pi^- \gamma(1S)$.
Data consistent with $J^P = 2^-$. The states with $J = 1$ and 3 also possibly seen, but need confirmation.

NODE=M177

NODE=M177

$\gamma_2(1D)$ MASS

NODE=M177M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10163.7±1.4 OUR AVERAGE		Error includes scale factor of 1.7.		
10164.5±0.8±0.5		DEL-AMO-SA..10R	BABR	$\gamma(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1±0.6±1.6	38	BONVICINI 04	CLE3	$\gamma(3S) \rightarrow 4\gamma\ell^+\ell^-$

NODE=M177M

$\gamma_2(1D)$ DECAY MODES

NODE=M177215;NODE=M177

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma \gamma(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	seen
$\Gamma_3 \quad \eta \gamma(1S)$	not seen
$\Gamma_4 \quad \pi^+\pi^- \gamma(1S)$	$(6.6\pm1.6) \times 10^{-3}$

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=4

$\gamma_2(1D)$ BRANCHING RATIOS

NODE=M177225

$\Gamma(\eta \gamma(1S))/\Gamma(\gamma\gamma \gamma(1S))$					Γ_3/Γ_1	
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<0.25	90	BONVICINI	04	CLE3	$\gamma(3S) \rightarrow 4\gamma \ell^+ \ell^-$	

NODE=M177R01
NODE=M177R01

$\Gamma(\pi^+\pi^-\Upsilon(1S))/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE (units 10^{-2})	DOCUMENT ID TECN COMMENT
$0.66^{+0.15}_{-0.14} \pm 0.06$	¹ DEL-AMO-SA...10R BABR $\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$

¹ Using theoretical predictions for $B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon_2(1D))$.

NODE=M177R03
NODE=M177R03

NODE=M177R03;LINKAGE=DE

$\Gamma(\pi^+\pi^-\Upsilon(1S))/\Gamma(\gamma\gamma\Upsilon(1S))$					Γ_4/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<1.2	90	² BONVICINI	04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

² Assuming $J = 2$.

NODE=M177R02
NODE=M177R02

NODE=M177R02;LINKAGE=BO

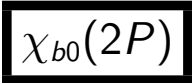
$\Upsilon_2(1D)$ REFERENCES

DEL-AMO-SA... 10R	PR D82 111102	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
BONVICINI 04	PR D70 032001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)

NODE=M177

REFID=53634
REFID=49759

NODE=M079



$I^G(J^{PC}) = 0^+(0^{++})$
 J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M079

$\chi_{b0}(2P)$ MASS

VALUE (MeV)	DOCUMENT ID
$10232.5 \pm 0.4 \pm 0.5$ OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M

NODE=M079M
→ UNCHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$	DOCUMENT ID	TECN	COMMENT
VALUE (MeV)			
23.8 ± 1.7	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M079M2
NODE=M079M2

γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M079DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
121.9 ± 0.4 OUR EVALUATION		Treating systematic errors as correlated		
122.2 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
$121.55 \pm 0.16 \pm 0.46$		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
123.0 ± 0.8	4959	¹ HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
124.6 ± 1.4	17	² HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$122.3 \pm 0.3 \pm 0.6$	9903	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$

NODE=M079DM
→ UNCHECKED ←

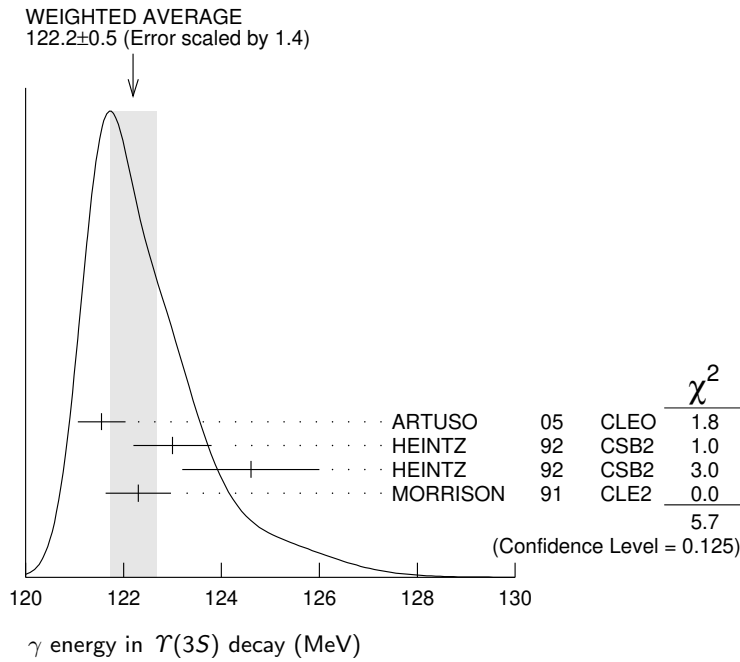
OCCUR=2

¹ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

NODE=M079DM;LINKAGE=A

² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M079DM;LINKAGE=B



$\chi_{b0}(2P)$ DECAY MODES

NODE=M079215;NODE=M079

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(2S)$	(1.38±0.30) %	
Γ_2 $\gamma \Upsilon(1S)$	(3.8 ±1.7) × 10 ⁻³	
Γ_3 $D^0 X$	< 8.2 %	90%
Γ_4 $\pi^+ \pi^- K^+ K^- \pi^0$	< 3.4 × 10 ⁻⁵	90%
Γ_5 $2\pi^+ \pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
Γ_6 $2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 2.2 × 10 ⁻⁴	90%
Γ_7 $2\pi^+ 2\pi^- 2\pi^0$	< 2.4 × 10 ⁻⁴	90%
Γ_8 $2\pi^+ 2\pi^- K^+ K^-$	< 1.5 × 10 ⁻⁴	90%
Γ_9 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2 × 10 ⁻⁴	90%
Γ_{10} $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1 × 10 ⁻³	90%
Γ_{11} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 7 × 10 ⁻⁴	90%
Γ_{12} $3\pi^+ 3\pi^-$	< 7 × 10 ⁻⁵	90%
Γ_{13} $3\pi^+ 3\pi^- 2\pi^0$	< 1.2 × 10 ⁻³	90%
Γ_{14} $3\pi^+ 3\pi^- K^+ K^-$	< 1.5 × 10 ⁻⁴	90%
Γ_{15} $3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7 × 10 ⁻⁴	90%
Γ_{16} $4\pi^+ 4\pi^-$	< 1.7 × 10 ⁻⁴	90%
Γ_{17} $4\pi^+ 4\pi^- 2\pi^0$	< 6 × 10 ⁻⁴	90%

DESIG=2

DESIG=1

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

$\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

$\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
1.38±0.30 OUR AVERAGE					
1.31±0.27 ^{+0.13} _{-0.12}		3,4 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$	
3.6 ±1.6 ±0.3		3,5 HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.8	90	6 LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$	
<8.9	90	7 CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$	

³ Assuming $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

⁴ LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] = (7.7 \pm 1.6) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91.

NODE=M079R2

NODE=M079R2

NODE=M079R2;LINKAGE=D

NODE=M079R2;LINKAGE=E

NODE=M079R2;LINKAGE=C

⁶ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.

NODE=M079R2;LINKAGE=LE

⁷ Using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) < 1.19 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R2;LINKAGE=B

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R1
NODE=M079R1**0.38±0.17 OUR AVERAGE**

0.36±0.17±0.03	8,9,10	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

0.9 ± 0.7 ± 0.1	9,11	HEINTZ	92	CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.2	90	¹² LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$

<2.5	90	¹³ CRAWFORD	92B	CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

⁸ LEES 14M quotes $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (2.1 \pm 1.0) \times 10^{-4}$ combining the results from $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ samples with and without photon conversions.

NODE=M079R1;LINKAGE=D

⁹ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M079R1;LINKAGE=E

¹⁰ LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ = $(2.1 \pm 1.0) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M079R1;LINKAGE=F

¹¹ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M079R1;LINKAGE=C

¹² LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.

NODE=M079R1;LINKAGE=LE

¹³ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) < 0.63 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P) \gamma) = 0.049$.

NODE=M079R1;LINKAGE=B

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R01
NODE=M079R01

<8.2 × 10 ⁻²	90	14,15 BRIERE	08	CLEO $\Upsilon(3S) \rightarrow \gamma D^0 X$

¹⁴ For $p_{D^0} > 2.5$ GeV/c.

NODE=M079R01;LINKAGE=BR

¹⁵ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01;LINKAGE=RI

$\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R02
NODE=M079R02

<0.34	90	¹⁶ ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

¹⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 2×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R02;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R03
NODE=M079R03

<0.5	90	¹⁷ ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

¹⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 3×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R03;LINKAGE=AS

$\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R04
NODE=M079R04

<2.2	90	¹⁸ ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

¹⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 13×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R05
NODE=M079R05

<2.4	90	¹⁹ ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

¹⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 14×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R05;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$ 20 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R06
NODE=M079R06

NODE=M079R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$ 21 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R07
NODE=M079R07

NODE=M079R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<11	90	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$ 22 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 63 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R08
NODE=M079R08

NODE=M079R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	23 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$ 23 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 39 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R09
NODE=M079R09

NODE=M079R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	24 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$ 24 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 4 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R10
NODE=M079R10

NODE=M079R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	25 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$ 25 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 72 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R11
NODE=M079R11

NODE=M079R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.5	90	26 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$ 26 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R12
NODE=M079R12

NODE=M079R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	27 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$ 27 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 43 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R13
NODE=M079R13

NODE=M079R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.7	90	28 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$ 28 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R14
NODE=M079R14

NODE=M079R14;LINKAGE=AS

$$\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	²⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
²⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ < 38×10^{-6} which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R15
NODE=M079R15

NODE=M079R15;LINKAGE=AS

$$\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_2/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	³⁰ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
³⁰ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.				

NODE=M079B01
NODE=M079B01

NODE=M079B01;LINKAGE=LE

$$B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.4 ± 0.9 OUR AVERAGE			
$1.7^{+1.5+0.1}_{-1.4-1.2}$	³¹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$1.3 \pm 1.0 \pm 0.3$	³² HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
³¹ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.			
³² Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.			

NODE=M079A02
NODE=M079A02

NODE=M079A02;LINKAGE=A
NODE=M079A02;LINKAGE=K

$$[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.71 ± 0.80	³³ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
³³ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.			

NODE=M079A00
NODE=M079A00

NODE=M079A00;LINKAGE=A

$$\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	³⁴ LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
³⁴ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) < 2.8\%$ using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.				

NODE=M079B02
NODE=M079B02

NODE=M079B02;LINKAGE=LE

$$B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.4 ± 1.6 OUR AVERAGE			
$6.6^{+4.9+2.0}_{-4.0-0.3}$	³⁵ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$4.0 \pm 1.7 \pm 0.3$	³⁶ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
³⁵ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.			
³⁶ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.			

NODE=M079A03
NODE=M079A03

NODE=M079A03;LINKAGE=A
NODE=M079A03;LINKAGE=B

$$[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
3.31 ± 0.56	³⁷ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
³⁷ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.			

NODE=M079A01
NODE=M079A01

NODE=M079A01;LINKAGE=A

$\chi_{b0}(2P)$ REFERENCES

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M079

REFID=56343
REFID=53936
REFID=52574
REFID=52577
REFID=50454
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

$\chi_{b1}(2P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M080

NODE=M080

$\chi_{b1}(2P)$ MASS

VALUE (MeV)

DOCUMENT ID

10255.46 ± 0.22 ± 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M080M

NODE=M080M

→ UNCHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

23.5 ± 0.7 ± 0.7¹ HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$

NODE=M080M2

NODE=M080M2

¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M080M2;LINKAGE=A

γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

99.26 ± 0.22 OUR EVALUATION

Treating systematic errors as correlated

99.53 ± 0.23 OUR AVERAGE

Error includes scale factor of 1.3. See the ideogram below.

99.15 ± 0.07 ± 0.25

ARTUSO

05

CLEO

 $\Upsilon(3S) \rightarrow \gamma X$

99 ± 1

169

CRAWFORD

92B

CLE2

 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

100.1 ± 0.4

11147

² HEINTZ

92

CSB2

 $e^+e^- \rightarrow \gamma X$

100.2 ± 0.5

223

³ HEINTZ

92

CSB2

 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

99.5 ± 0.1 ± 0.5

25759

MORRISON

91

CLE2

 $e^+e^- \rightarrow \gamma X$

NODE=M080DM

NODE=M080DM

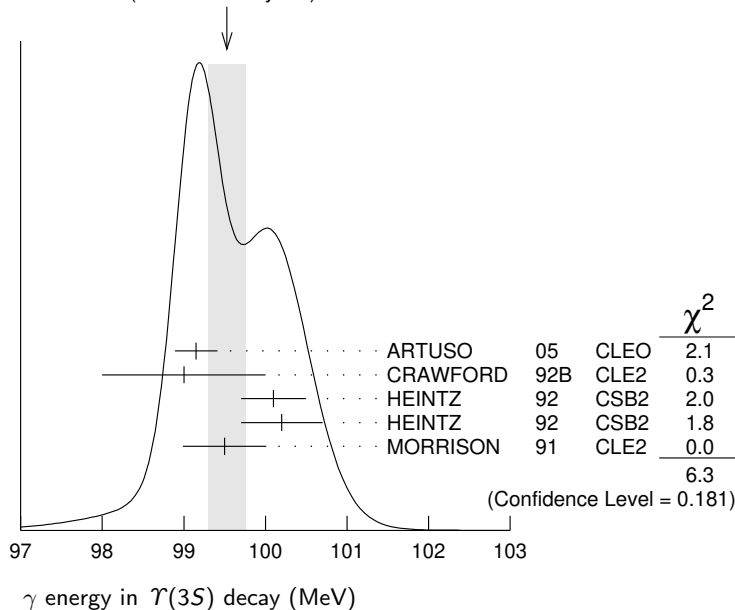
→ UNCHECKED ←

OCCUR=2

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B

WEIGHTED AVERAGE
99.53 ± 0.23 (Error scaled by 1.3)



$\chi_{b1}(2P)$ DECAY MODES

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad \omega \Upsilon(1S)$	$(1.63^{+0.40}_{-0.34}) \%$	DESIG=3
$\Gamma_2 \quad \gamma \Upsilon(2S)$	$(18.1 \pm 1.9) \%$	DESIG=2
$\Gamma_3 \quad \gamma \Upsilon(1S)$	$(9.9 \pm 1.0) \%$	DESIG=1
$\Gamma_4 \quad \pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$	DESIG=4
$\Gamma_5 \quad D^0 X$	$(8.8 \pm 1.7) \%$	DESIG=5
$\Gamma_6 \quad \pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$	DESIG=6
$\Gamma_7 \quad 2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$	DESIG=7
$\Gamma_8 \quad 2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$	DESIG=8
$\Gamma_9 \quad 2\pi^+ 2\pi^- 2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$	DESIG=9
$\Gamma_{10} \quad 2\pi^+ 2\pi^- K^+ K^-$	$(10 \pm 4) \times 10^{-5}$	DESIG=10
$\Gamma_{11} \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	DESIG=11
$\Gamma_{12} \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(10 \pm 4) \times 10^{-4}$	DESIG=12
$\Gamma_{13} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	DESIG=13
$\Gamma_{14} \quad 3\pi^+ 3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	DESIG=14
$\Gamma_{15} \quad 3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	DESIG=15
$\Gamma_{16} \quad 3\pi^+ 3\pi^- K^+ K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	DESIG=16
$\Gamma_{17} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	DESIG=17
$\Gamma_{18} \quad 4\pi^+ 4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	DESIG=18
$\Gamma_{19} \quad 4\pi^+ 4\pi^- 2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	DESIG=19

 $\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

 $\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.63^{+0.35}_{-0.31} \pm 0.16_{-0.15}$	$32.6^{+6.9}_{-6.1}$	4 CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma\omega \Upsilon(1S)$

NODE=M080R3
NODE=M080R3

⁴ Using $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 2 (2.48 \pm 0.06)\%$.

NODE=M080R3;LINKAGE=CR

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.181 ± 0.019 OUR AVERAGE				
$0.211 \pm 0.017 \pm 0.019$	^{5,6,7}	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$0.190 \pm 0.018 \pm 0.017$	^{4.3k}	⁸ LEES	11J	BABR $\Upsilon(3S) \rightarrow X\gamma$
$0.206 \pm 0.035 \pm 0.019$	^{5,9}	CRAWFORD	92B	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
$0.132 \pm 0.018 \pm 0.012$	^{5,10}	HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

NODE=M080R2
NODE=M080R2

⁵ Assuming $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

NODE=M080R2;LINKAGE=D
NODE=M080R2;LINKAGE=E

⁶ LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}}$
 $= (2.66 \pm 0.22)\%$ combining the results from $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ samples with and without photon conversions.

⁷ LEES 14M reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$
 $= (2.66 \pm 0.22) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) =$
 $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R2;LINKAGE=F

⁸ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))]$
 $= (2.4 \pm 0.1 \pm 0.2) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) =$
 $(12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R2;LINKAGE=LE

⁹ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2$
 $B(\Upsilon(2S) \rightarrow \ell^+\ell^-) = (10.23 \pm 1.20 \pm 1.26) 10^{-4}$.

NODE=M080R2;LINKAGE=B

¹⁰ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) =$
 $(2.29 \pm 0.23 \pm 0.21) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$.
 Supersedes HEINTZ 91.

NODE=M080R2;LINKAGE=C

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.099±0.010 OUR AVERAGE				
0.107±0.006±0.010	11,12,13	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
0.098±0.005±0.009	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$
0.103±0.023±0.009	11,15	CRAWFORD	92B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
0.075±0.010±0.007	11,16	HEINTZ	92 CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M080R1
 NODE=M080R1

¹¹ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

¹² LEES 14M quotes $\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}} = (13.48 \pm 0.72) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M080R1;LINKAGE=D
 NODE=M080R1;LINKAGE=E

¹³ LEES 14M reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (13.48 \pm 0.72) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R1;LINKAGE=G

¹⁴ LEES 11J reports $[\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (12.4 \pm 0.3 \pm 0.6) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R1;LINKAGE=LE

¹⁵ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (6.47 \pm 1.12 \pm 0.82) 10^{-4}$.

NODE=M080R1;LINKAGE=B

¹⁶ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91.

NODE=M080R1;LINKAGE=F

 $\Gamma(\pi\pi\chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.3 OUR AVERAGE				
9.2±1.1±0.8	31k	17 LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$
8.6±2.3±2.1		18 CAWLFIELD	06 CLE3	$\Upsilon(3S) \rightarrow 2(\gamma \pi \ell)$

NODE=M080R4
 NODE=M080R4

¹⁷ LEES 11C measures $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P) X) \times B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P) \pi^+ \pi^-) = (1.16 \pm 0.07 \pm 0.12) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P) X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P) \gamma) = (12.6 \pm 1.2) \times 10^{-2}$.

NODE=M080R4;LINKAGE=LE

¹⁸ CAWLFIELD 06 quote $\Gamma(\chi_{b1}(2P) \rightarrow \pi\pi\chi_{b1}(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M080R4;LINKAGE=CA

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.8±1.5±0.8	2243	19 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

NODE=M080R01
 NODE=M080R01

¹⁹ For $p_{D^0} > 2.5$ GeV/c.

NODE=M080R01;LINKAGE=BR

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	20 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

NODE=M080R02
 NODE=M080R02

²⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (39 \pm 8 \pm 9) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	21 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

NODE=M080R03
 NODE=M080R03

²¹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (14 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	22 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

NODE=M080R04
 NODE=M080R04

²² ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (97 \pm 30 \pm 26) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M080R04;LINKAGE=AS

$\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.9±2.0±0.5	36	²³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$
²³ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (74 \pm 16 \pm 19) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R05
NODE=M080R05

NODE=M080R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.4±0.1	12	²⁴ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$
²⁴ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R06
NODE=M080R06

NODE=M080R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5±1.7±0.5	38	²⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$
²⁵ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (69 \pm 13 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R07
NODE=M080R07

NODE=M080R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
9.6±3.5±0.9	27	²⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$
²⁶ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (121 \pm 29 \pm 33) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R08
NODE=M080R08

NODE=M080R08;LINKAGE=AS

 $\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.7±2.5±0.6	17	²⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
²⁷ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (85 \pm 23 \pm 22) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R09
NODE=M080R09

NODE=M080R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.4±0.1	18	²⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$
²⁸ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (15 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R10
NODE=M080R10

NODE=M080R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	44	²⁹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
²⁹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (150 \pm 30 \pm 40) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R11
NODE=M080R11

NODE=M080R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.0±0.7±0.2	16	³⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
³⁰ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$ $= (25 \pm 7 \pm 6) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))$ $= (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R12
NODE=M080R12

NODE=M080R12;LINKAGE=AS

$\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.1±0.6	25	³¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
³¹ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (77 \pm 17 \pm 21) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R13
 NODE=M080R13

NODE=M080R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.2	16	³² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
³² ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (22 \pm 6 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R14
 NODE=M080R14

NODE=M080R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
19±7±2	41	³³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
³³ ASNER 08A reports $[\Gamma(\chi_{b1}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))] = (241 \pm 47 \pm 72) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) = (12.6 \pm 1.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M080R15
 NODE=M080R15

NODE=M080R15;LINKAGE=AS

 $\chi_{b1}(2P)$ Cross-Particle Branching Ratios

NODE=M080230

$$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
12.4±0.3±0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B01
 NODE=M080B01

 $B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

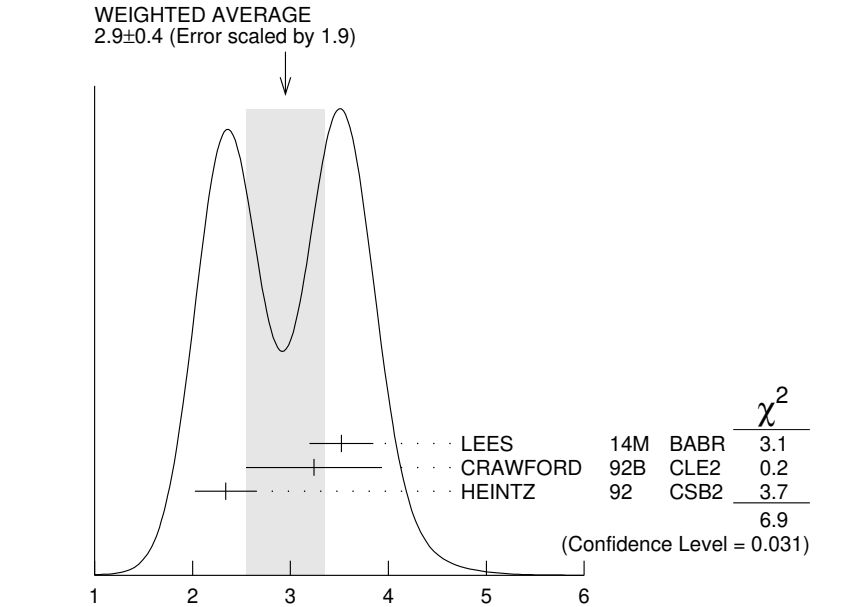
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ±0.4 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		

NODE=M080A00
 NODE=M080A00

3.52 ^{+0.28+0.17} _{-0.27-0.18}		³⁴ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
3.24±0.56±0.41	58	³⁵ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.34±0.28±0.15		³⁶ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
³⁴ From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.				
³⁵ CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS)) B(\Upsilon(nS) \rightarrow \ell^+ \ell^-)$.				
³⁶ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) = (0.91 \pm 0.11 \pm 0.06)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.				

NODE=M080A00;LINKAGE=A
 NODE=M080A00;LINKAGE=C

NODE=M080A00;LINKAGE=B



$B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$
(units 10^{-4})

$\Gamma(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) / \Gamma_{\text{total}}$
 $\Gamma_2 / \Gamma \times \Gamma_{21}^{\Upsilon(3S)} / \Gamma \Upsilon(3S)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.1±0.2	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X \gamma$

NODE=M080B02
NODE=M080B02

$B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$

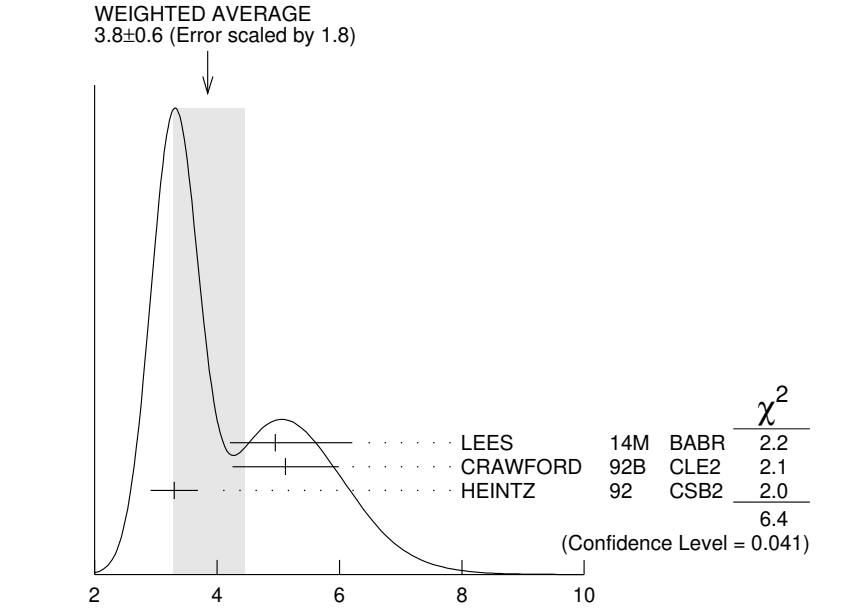
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ±0.6 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
4.95 ^{+0.75} _{-0.70} ±1.01		37 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
5.12±0.60±0.63	111	38 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
3.30±0.33±0.20		39 HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M080A01
NODE=M080A01

- 37 From a sample of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with one converted photon.
38 CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon(nS))$
 $B(\Upsilon(nS) \rightarrow \ell^+ \ell^-)$.
39 Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) = (2.29 \pm 0.23 \pm 0.21) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10) \%$.

NODE=M080A01;LINKAGE=A
NODE=M080A01;LINKAGE=C

NODE=M080A01;LINKAGE=B



$B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+ \ell^-)$
(units 10^{-4})

$B(\chi_{b1}(2P) \rightarrow \chi_{b1}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X)$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.16 \pm 0.07 \pm 0.12$	31k	LEES	11c BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M080R16
 NODE=M080R16

 $B(\chi_{b2}(2P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(2P) \rightarrow pX + \bar{p}X)$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.109 \pm 0.007 \pm 0.040$	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)$

NODE=M080R20
 NODE=M080R20

 $B(\chi_{b0}(2P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(2P) \rightarrow pX + \bar{p}X)$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.082 \pm 0.025 \pm 0.060$	BRIERE	07 CLEO	$\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)$

NODE=M080R21
 NODE=M080R21

 $\chi_{b1}(2P)$ REFERENCES

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CRAWFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HENNESSY	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M080

REFID=56343
 REFID=16775
 REFID=53936
 REFID=52574
 REFID=52577
 REFID=51887
 REFID=50997
 REFID=50454
 REFID=49766
 REFID=43177
 REFID=43604
 REFID=41580
 REFID=41634
 REFID=41586

 $h_b(2P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Quantum numbers are quark model predictions. $C = -$ established by $\eta_b\gamma$ decay.

NODE=M205

NODE=M205

 $h_b(2P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$10259.8 \pm 0.5 \pm 1.1$	90k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \pi^+\pi^-$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$10259.8 \pm 0.6^{+1.4}_{-1.0}$	83.9k	² ADACHI	12 BELL	$10.86 e^+e^- \rightarrow \pi^+\pi^-$ MM

¹ Observed with 9 standard deviations significance.

² Superseded by MIZUK 12.

NODE=M205M

NODE=M205M

NODE=M205M;LINKAGE=A
 NODE=M205M;LINKAGE=AD

 $h_b(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	not seen
Γ_2 $\eta_b(1S)\gamma$	$(22 \pm 5) \%$
Γ_3 $\eta_b(2S)\gamma$	$(48 \pm 13) \%$

NODE=M205215;NODE=M205

DESIG=1

DESIG=2

DESIG=3

 $h_b(2P)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	83.9k	ADACHI	12 BELL	$10.86\ e^+e^- \rightarrow \pi^+\pi^-$ MM

NODE=M205225

NODE=M205R01
 NODE=M205R01

$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ
<u>VALUE (units 10^{-2})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$22.3 \pm 3.8^{+3.1}_{-3.3}$	10k	MIZUK	12 BELL	$e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons

NODE=M205R02
 NODE=M205R02

$\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$				Γ_3/Γ
<u>VALUE (units 10^{-2})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$47.5 \pm 10.5^{+6.8}_{-7.7}$	26k	MIZUK	12 BELL	$e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons

NODE=M205R03
 NODE=M205R03

 $h_b(2P)$ REFERENCES

ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M205

REFID=53962
 REFID=54718

$\chi_{b2}(2P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Observed in radiative decay of the $\Upsilon(3S)$, therefore $C = +$. Branching ratio requires E1 transition, M1 is strongly disfavored, therefore $P = +$.

NODE=M081

NODE=M081

 $\chi_{b2}(2P)$ MASS

NODE=M081M

VALUE (MeV) DOCUMENT ID
10268.65 $\pm$ 0.22 $\pm$ 0.50 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 $\pm$ 0.5 MeV

NODE=M081M
 → UNCHECKED ←

 $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

NODE=M081M2

VALUE (MeV) DOCUMENT ID TECN COMMENT
13.10 $\pm$ 0.24 OUR AVERAGE
 12.3 $\pm$ 2.6 $\pm$ 0.6 ¹ AAIJ 14BG LHCB $pp \rightarrow \gamma \mu^+ \mu^- X$
 13.04 $\pm$ 0.26 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
 13.5 $\pm$ 0.4 $\pm$ 0.5 ² HEINTZ 92 CSB2 $e^+ e^- \rightarrow \gamma X, \ell^+ \ell^- \gamma \gamma$
¹ From the $\chi_{bj}(2P) \rightarrow \Upsilon(1S) \gamma$ transition.
² From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M081M2

NODE=M081M2;LINKAGE=B
 NODE=M081M2;LINKAGE=A

 γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M081DM

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
86.19 $\pm$ 0.22 OUR EVALUATION Treating systematic errors as correlated
86.40 $\pm$ 0.18 OUR AVERAGE
 86.04 $\pm$ 0.06 $\pm$ 0.27 ARTUSO 05 CLEO $\Upsilon(3S) \rightarrow \gamma X$
 86 $\pm$ 1 101 CRAWFORD 92B CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
 86.7 $\pm$ 0.4 10319 ³ HEINTZ 92 CSB2 $e^+ e^- \rightarrow \gamma X$
 86.9 $\pm$ 0.4 157 ⁴ HEINTZ 92 CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
 86.4 $\pm$ 0.1 $\pm$ 0.4 30741 MORRISON 91 CLE2 $e^+ e^- \rightarrow \gamma X$
³ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
⁴ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M081DM
 → UNCHECKED ←

OCCUR=2

NODE=M081DM;LINKAGE=A

NODE=M081DM;LINKAGE=B

 $\chi_{b2}(2P)$ DECAY MODES

NODE=M081215;NODE=M081

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \omega \Upsilon(1S)$	(1.10 $^{+0.34}_{-0.30}$) %	
$\Gamma_2 \quad \gamma \Upsilon(2S)$	(8.9 $\pm$ 1.2) %	
$\Gamma_3 \quad \gamma \Upsilon(1S)$	(6.6 $\pm$ 0.8) %	
$\Gamma_4 \quad \pi \pi \chi_{b2}(1P)$	(5.1 $\pm$ 0.9) $\times 10^{-3}$	
$\Gamma_5 \quad D^0 X$	< 2.4 %	90%
$\Gamma_6 \quad \pi^+ \pi^- K^+ K^- \pi^0$	< 1.1 $\times 10^{-4}$	90%
$\Gamma_7 \quad 2\pi^+ \pi^- K^- K_S^0$	< 9 $\times 10^{-5}$	90%
$\Gamma_8 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 7 $\times 10^{-4}$	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- 2\pi^0$	(3.9 $\pm$ 1.6) $\times 10^{-4}$	
$\Gamma_{10} \quad 2\pi^+ 2\pi^- K^+ K^-$	(9 $\pm$ 4) $\times 10^{-5}$	
$\Gamma_{11} \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.4 $\pm$ 1.1) $\times 10^{-4}$	
$\Gamma_{12} \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(4.7 $\pm$ 2.3) $\times 10^{-4}$	
$\Gamma_{13} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 4 $\times 10^{-4}$	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^-$	(9 $\pm$ 4) $\times 10^{-5}$	
$\Gamma_{15} \quad 3\pi^+ 3\pi^- 2\pi^0$	(1.2 $\pm$ 0.4) $\times 10^{-3}$	
$\Gamma_{16} \quad 3\pi^+ 3\pi^- K^+ K^-$	(1.4 $\pm$ 0.7) $\times 10^{-4}$	
$\Gamma_{17} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	(4.2 $\pm$ 1.7) $\times 10^{-4}$	
$\Gamma_{18} \quad 4\pi^+ 4\pi^-$	(9 $\pm$ 5) $\times 10^{-5}$	
$\Gamma_{19} \quad 4\pi^+ 4\pi^- 2\pi^0$	(1.3 $\pm$ 0.5) $\times 10^{-3}$	

DESIG=3

DESIG=2

DESIG=1

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

DESIG=9

DESIG=10

DESIG=11

DESIG=12

DESIG=13

DESIG=14

DESIG=15

DESIG=16

DESIG=17

DESIG=18

DESIG=19

$\chi_{b2}(2P)$ BRANCHING RATIOS

NODE=M081220

 $\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.10^{+0.32+0.11}_{-0.28-0.10}$	$20.1^{+5.8}_{-5.1}$	5 CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

NODE=M081R3
NODE=M081R3

⁵ Using $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.4 \pm 0.8)\%$ and $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2$ ($2.48 \pm 0.06\%$).

NODE=M081R3;LINKAGE=CR

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.089 ± 0.012 OUR AVERAGE				
$0.085 \pm 0.010 \pm 0.010$	$6^{7,8}$	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$0.084 \pm 0.011 \pm 0.010$	$2.5k$	⁹ LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$
$0.096 \pm 0.022 \pm 0.012$	7^{10}	CRAWFORD	92B	CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.106 \pm 0.016 \pm 0.013$	7^{11}	HEINTZ	92	CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M081R2
NODE=M081R2

⁶ LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $= (1.12 \pm 0.13)\%$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M081R2;LINKAGE=D

⁷ Assuming $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

NODE=M081R2;LINKAGE=E

⁸ LEES 14M reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] =$
 $(1.12 \pm 0.13) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R2;LINKAGE=F

⁹ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] =$
 $(1.1 \pm 0.1 \pm 0.1) \times 10^{-2}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R2;LINKAGE=LE

¹⁰ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2$
 $B(\Upsilon(2S) \rightarrow \ell^+ \ell^-) = (4.98 \pm 0.94 \pm 0.62) 10^{-4}$.

NODE=M081R2;LINKAGE=B

¹¹ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) =$
 $(1.90 \pm 0.23 \pm 0.18) \%$ using $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.
 Supersedes HEINTZ 91.

NODE=M081R2;LINKAGE=C

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.066 ± 0.008 OUR AVERAGE				
$0.061 \pm 0.004 \pm 0.007$	$12^{13,14}$	LEES	14M	BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
$0.070 \pm 0.004 \pm 0.008$	$11k$	¹⁵ LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$
$0.077 \pm 0.018 \pm 0.009$	13^{16}	CRAWFORD	92B	CLE2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.061 \pm 0.009 \pm 0.007$	13^{17}	HEINTZ	92	CSB2 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

NODE=M081R1
NODE=M081R1

¹² LEES 14M quotes $\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$
 $= (8.03 \pm 0.50) \times 10^{-3}$ combining the results from samples of $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M081R1;LINKAGE=D

¹³ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

NODE=M081R1;LINKAGE=E

¹⁴ LEES 14M reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] =$
 $(8.03 \pm 0.50) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=F

¹⁵ LEES 11J reports $[\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] =$
 $(9.2 \pm 0.3 \pm 0.4) \times 10^{-3}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) =$
 $(13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R1;LINKAGE=LE

¹⁶ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2$
 $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.03 \pm 0.94 \pm 0.63) 10^{-4}$.

NODE=M081R1;LINKAGE=B

¹⁷ Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) =$
 $(0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.05)\%$.
 Supersedes HEINTZ 91.

NODE=M081R1;LINKAGE=C

 $\Gamma(\pi \pi \chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.1 ± 0.9 OUR AVERAGE				
$4.9 \pm 0.7 \pm 0.6$	$17k$	¹⁸ LEES	11C	BABR $e^+ e^- \rightarrow \pi^+ \pi^- X$
$6.0 \pm 1.6 \pm 1.4$		¹⁹ CAWLFIELD	06	CLE3 $\Upsilon(3S) \rightarrow 2(\gamma \pi \ell)$

NODE=M081R4
NODE=M081R4

¹⁸ $(0.64 \pm 0.05 \pm 0.08) \times 10^{-3}$. We derive the value assuming $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P) X) =$
 $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P) \gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

NODE=M081R4;LINKAGE=LE

¹⁹ CAWLFIELD 06 quote $\Gamma(\chi_{b2}(2P) \rightarrow \pi \pi \chi_{b2}(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ keV
 assuming l-spin conservation, no D-wave contribution, $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$ keV, and
 $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$ keV.

NODE=M081R4;LINKAGE=CA

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.4 × 10⁻²	90	20,21 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

²⁰ For $p_{D^0} > 2.5 \text{ GeV}/c$.

²¹ The authors also present their result as $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$.

NODE=M081R01
NODE=M081R01

NODE=M081R01;LINKAGE=BR
NODE=M081R01;LINKAGE=RI

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<1.1	90	²² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

²² ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R02
NODE=M081R02

NODE=M081R02;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	²³ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

²³ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 12 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R03
NODE=M081R03

NODE=M081R03;LINKAGE=AS

 $\Gamma(2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	²⁴ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

²⁴ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 87 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.

NODE=M081R04
NODE=M081R04

NODE=M081R04;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
3.9 ± 1.6 ± 0.5	23	²⁵ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

²⁵ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (51 \pm 16 \pm 13) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R05
NODE=M081R05

NODE=M081R05;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
0.9 ± 0.4 ± 0.1	11	²⁶ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

²⁶ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R06
NODE=M081R06

NODE=M081R06;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 ± 1.0 ± 0.3	16	²⁷ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

²⁷ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (32 \pm 11 \pm 8) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R07
NODE=M081R07

NODE=M081R07;LINKAGE=AS

 $\Gamma(2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
4.7 ± 2.2 ± 0.6	14	²⁸ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

²⁸ ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (62 \pm 23 \pm 17) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M081R08
NODE=M081R08

NODE=M081R08;LINKAGE=AS

$\Gamma(3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	29 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
29 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 58 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$.				

NODE=M081R09
 NODE=M081R09

NODE=M081R09;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	14	30 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$
30 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R10
 NODE=M081R10

NODE=M081R10;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
12±4±1	45	31 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
31 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (159 \pm 33 \pm 43) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R11
 NODE=M081R11

NODE=M081R11;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.4±0.7±0.2	12	32 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
32 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (19 \pm 7 \pm 5) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R12
 NODE=M081R12

NODE=M081R12;LINKAGE=AS

 $\Gamma(3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.7±0.5	16	33 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$
33 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (55 \pm 16 \pm 15) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R13
 NODE=M081R13

NODE=M081R13;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.9±0.4±0.1	9	34 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$
34 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 5 \pm 3) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R14
 NODE=M081R14

NODE=M081R14;LINKAGE=AS

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13±5±2	27	35 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
35 ASNER 08A reports $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (165 \pm 46 \pm 50) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M081R15
 NODE=M081R15

NODE=M081R15;LINKAGE=AS

 $\chi_{b2}(2P)$ Cross-Particle Branching Ratios

NODE=M081230

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma \times \Gamma_{20}^{\Upsilon(3S)}/\Gamma \Upsilon(3S)$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.2±0.3±0.4	11k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M081B01
 NODE=M081B01

$$\Gamma(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) / \Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) / \Gamma_{\text{total}}$$

$$\Gamma_2 / \Gamma \times \Gamma_{20}^{\Upsilon(3S)} / \Gamma \Upsilon(3S)$$

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
1.1±0.1±0.1	2.5k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M081B02
NODE=M081B02

$$B(\chi_{b2}(2P) \rightarrow \chi_{b2}(1P)\pi^+\pi^-) \times B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X)$$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.64±0.05±0.08	17k	LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M081R16
NODE=M081R16

$$B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.02±0.18 OUR AVERAGE				

1.95 ^{+0.22+0.10} _{-0.21-0.16}		³⁶ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
2.52±0.47±0.32	48	³⁷ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
1.98±0.28±0.12		³⁸ HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$

³⁶ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with converted photons.
³⁷ CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))$
 $B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$.
³⁸ Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma\Upsilon(1S)) = (0.77 \pm 0.11 \pm 0.05)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$.

NODE=M081A01
NODE=M081A01

NODE=M081A01;LINKAGE=A
NODE=M081A01;LINKAGE=C

NODE=M081A01;LINKAGE=B

$$[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
66.6±3.0	³⁹ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

³⁹ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ events without converted photons.

NODE=M081A00
NODE=M081A00

NODE=M081A00;LINKAGE=A

$$B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+\ell^-)$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.74±0.29 OUR AVERAGE				

3.22 ^{+0.58+0.16} _{-0.53-0.71}		⁴⁰ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
2.49±0.47±0.31	53	⁴¹ CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
2.74±0.33±0.18		⁴² HEINTZ	92 CSB2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$

⁴⁰ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ with converted photons.
⁴¹ CRAWFORD 92B quotes $2 \times B(\Upsilon(3S) \rightarrow \gamma\chi_{bJ}(2P)) B(\chi_{bJ}(2P) \rightarrow \gamma\Upsilon(nS))$
 $B(\Upsilon(nS) \rightarrow \ell^+\ell^-)$.
⁴² Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma\Upsilon(2S)) = (1.90 \pm 0.23 \pm 0.18)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$.

NODE=M081A02
NODE=M081A02

NODE=M081A02;LINKAGE=A
NODE=M081A02;LINKAGE=C

NODE=M081A02;LINKAGE=B

$$[B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
46.9±2.0	⁴³ LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

⁴³ From a sample of $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ without converted photons.

NODE=M081A03
NODE=M081A03

NODE=M081A03;LINKAGE=A

$\chi_{b2}(2P)$ REFERENCES

AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HEN...	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)

NODE=M081

REFID=56199
REFID=56343
REFID=16775
REFID=53936
REFID=52574
REFID=52577
REFID=50997
REFID=50454
REFID=49766
REFID=43177
REFID=43604
REFID=41580
REFID=41634
REFID=41586

$\Upsilon(3S)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.1±0.5	¹ SHAMOV	23	RVUE $e^+e^- \rightarrow$ hadrons
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10355.2±0.5	^{2,3} ARTAMONOV	00	MD1 $e^+e^- \rightarrow$ hadrons
10355.3±0.5	^{4,5} BARU	86B	MD1 $e^+e^- \rightarrow$ hadrons
¹ Reanalysis of MD1 data using the electron mass from COHEN 87, the radiative corrections from KURAEV 85 and interference effects.			
² Reanalysis of BARU 86B using new electron mass (COHEN 87).			
³ Superseded by SHAMOV 23.			
⁴ Reanalysis of ARTAMONOV 84.			
⁵ Superseded by ARTAMONOV 00.			

NODE=M048M

NODE=M048M;LINKAGE=A

NODE=M048M;LINKAGE=AR
 NODE=M048M;LINKAGE=B
 NODE=M048M;LINKAGE=C
 NODE=M048M;LINKAGE=RZ

 $m\Upsilon(3S) - m\Upsilon(2S)$

NODE=M048DM2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
331.50±0.02±0.13	LEES	11C	BABR $e^+e^- \rightarrow \pi^+\pi^-X$

NODE=M048DM2

 $\Upsilon(3S)$ WIDTH

NODE=M048W

VALUE (keV)	DOCUMENT ID
20.32±1.85 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M048W
 → UNCHECKED ←

 $\Upsilon(3S)$ DECAY MODES

NODE=M048215;NODE=M048

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\Upsilon(2S)$ anything	(10.6 ± 0.8) %	
Γ_2 $\Upsilon(2S)\pi^+\pi^-$	(2.82± 0.18) %	S=1.6
Γ_3 $\Upsilon(2S)\pi^0\pi^0$	(1.85± 0.14) %	
Γ_4 $\Upsilon(2S)\gamma\gamma$	(5.0 ± 0.7) %	
Γ_5 $\Upsilon(2S)\pi^0$	< 5.1 × 10 ⁻⁴	CL=90%
Γ_6 $\Upsilon(1S)\pi^+\pi^-$	(4.37± 0.08) %	
Γ_7 $\Upsilon(1S)\pi^0\pi^0$	(2.20± 0.13) %	
Γ_8 $\Upsilon(1S)\eta$	< 1 × 10 ⁻⁴	CL=90%
Γ_9 $\Upsilon(1S)\pi^0$	< 7 × 10 ⁻⁵	CL=90%
Γ_{10} $h_b(1P)\pi^0$	< 1.2 × 10 ⁻³	CL=90%
Γ_{11} $h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 ± 1.4) × 10 ⁻⁴	
Γ_{12} $h_b(1P)\pi^+\pi^-$	< 1.2 × 10 ⁻⁴	CL=90%
Γ_{13} $\tau^+\tau^-$	(2.29± 0.30) %	
Γ_{14} $\mu^+\mu^-$	(2.18± 0.21) %	S=2.1
Γ_{15} e^+e^-	(2.18± 0.20) %	
Γ_{16} hadrons	(93 ± 12) %	
Γ_{17} ggg	(35.7 ± 2.6) %	
Γ_{18} γgg	(9.7 ± 1.8) × 10 ⁻³	
Γ_{19} ^2H anything	(2.33± 0.33) × 10 ⁻⁵	

DESIG=8

DESIG=4

DESIG=10

DESIG=12

DESIG=107

DESIG=3

DESIG=11

DESIG=9

DESIG=106

DESIG=112

DESIG=113

DESIG=114

DESIG=16

DESIG=1

DESIG=2

DESIG=101

DESIG=109

DESIG=110

DESIG=117

Radiative decays

NODE=M048;CLUMP=B

Γ_{20} $\gamma\chi_{b2}(2P)$	(13.1 ± 1.6) %	S=3.4
Γ_{21} $\gamma\chi_{b1}(2P)$	(12.6 ± 1.2) %	S=2.4
Γ_{22} $\gamma\chi_{b0}(2P)$	(5.9 ± 0.6) %	S=1.4
Γ_{23} $\gamma\chi_{b2}(1P)$	(10.0 ± 1.0) × 10 ⁻³	S=1.7
Γ_{24} $\gamma\chi_{b1}(1P)$	(9 ± 5) × 10 ⁻⁴	S=1.8
Γ_{25} $\gamma\chi_{b0}(1P)$	(2.7 ± 0.4) × 10 ⁻³	
Γ_{26} $\gamma\eta_b(2S)$	< 6.2 × 10 ⁻⁴	CL=90%
Γ_{27} $\gamma\eta_b(1S)$	(5.1 ± 0.7) × 10 ⁻⁴	
Γ_{28} $\gamma A^0 \rightarrow \gamma$ hadrons	< 8 × 10 ⁻⁵	CL=90%
Γ_{29} $\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] < 2.2 × 10 ⁻⁴	CL=95%
Γ_{30} $\gamma A^0 \rightarrow \gamma\mu^+\mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
Γ_{31} $\gamma A^0 \rightarrow \gamma\tau^+\tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

DESIG=5

DESIG=6

DESIG=7

DESIG=103

DESIG=104

DESIG=13

DESIG=14

DESIG=15

DESIG=115

DESIG=102

DESIG=116

DESIG=108

Lepton Family number (LF) violating modes

Γ_{32}	$e^{\pm}\tau^{\mp}$	LF	< 4.2	$\times 10^{-6}$	CL=90%
Γ_{33}	$e^{\pm}\mu^{\mp}$	LF	< 3.6	$\times 10^{-7}$	CL=90%
Γ_{34}	$\mu^{\pm}\tau^{\mp}$	LF	< 3.1	$\times 10^{-6}$	CL=90%

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$ [b] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

NODE=M048;CLUMP=C

DESIG=111

DESIG=119

DESIG=105

LINKAGE=C48

LINKAGE=MRG

 $\Upsilon(3S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M048218

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ **$\Gamma_{16} \Gamma_{15} / \Gamma$**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.414 ± 0.007 OUR AVERAGE			
0.413 ± 0.004 ± 0.006	ROSNER	06	CLEO $10.4 e^+e^- \rightarrow \text{hadrons}$
0.45 ± 0.03 ± 0.03	⁶ GILES	84B	CLEO $e^+e^- \rightarrow \text{hadrons}$

NODE=M048G2

NODE=M048G2

⁶ Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M048G2;LINKAGE=R

 $\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ **$\Gamma_6 \Gamma_{15} / \Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.46 ± 0.27 ± 0.77	6.4k	⁷ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

NODE=M048G01

NODE=M048G01

⁷ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

NODE=M048G01;LINKAGE=AU

 $\Upsilon(3S)$ PARTIAL WIDTHS

NODE=M048220

 $\Gamma(e^+e^-)$ **Γ_{15}**

VALUE (keV)	DOCUMENT ID
0.443 ± 0.008 OUR EVALUATION	

NODE=M048W2

NODE=M048W2

→ UNCHECKED ←

 $\Upsilon(3S)$ BRANCHING RATIOS

NODE=M048225

 $\Gamma(\Upsilon(2S)\text{anything}) / \Gamma_{\text{total}}$ **Γ_1 / Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.106 ± 0.008 OUR AVERAGE				
0.1023 ± 0.0105	4625	^{8,9,10} BUTLER	94B	CLE2 $e^+e^- \rightarrow \ell^+\ell^-X$
0.111 ± 0.012	4891	^{9,10,11} BROCK	91	CLEO $e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$

NODE=M048R8

NODE=M048R8

⁸ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R;LINKAGE=A

⁹ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=B

¹⁰ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (18.5 \pm 0.8)\%$.

NODE=M048R;LINKAGE=D

¹¹ Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=C

 $\Gamma(\Upsilon(2S)\pi^+\pi^-) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.82 ± 0.18 OUR AVERAGE				Error includes scale factor of 1.6. See the ideogram below.
3.00 ± 0.02 ± 0.14	543k	LEES	11C	BABR $e^+e^- \rightarrow \pi^+\pi^-X$
2.40 ± 0.10 ± 0.26	800	¹² AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-e^+e^-$
3.12 ± 0.49	980	^{13,14} BUTLER	94B	CLE2 $e^+e^- \rightarrow \pi^+\pi^-\ell^+\ell^-$
2.13 ± 0.38	974	¹⁵ BROCK	91	CLEO $e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$

NODE=M048R4

NODE=M048R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.82 ± 0.65 ± 0.53 138 ¹⁵ WU 93 CUSB $\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$ 3.1 ± 2.0 5 MAGERAS 82 CUSB $\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$ ¹² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008 \text{ keV}$.

NODE=M048R4;LINKAGE=AU

¹³ From the exclusive mode.

NODE=M048R;LINKAGE=M

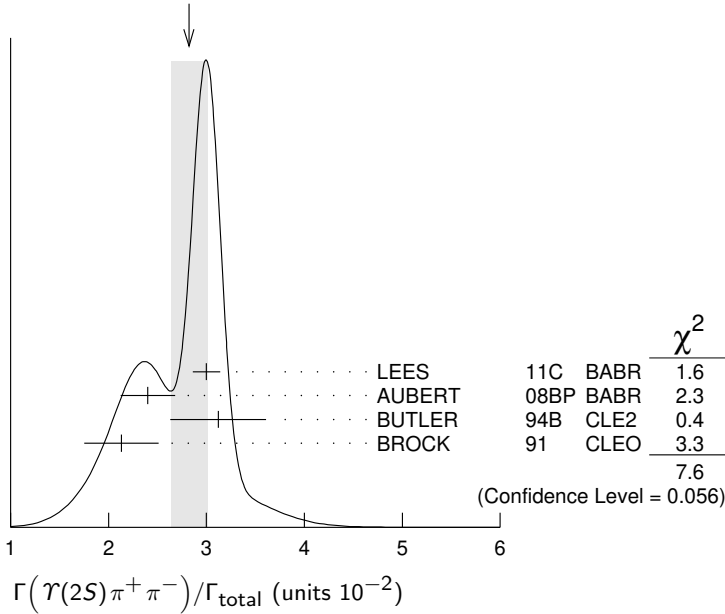
¹⁴ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) = (0.038 \pm 0.007)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) = (1/2)B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-)$.

NODE=M048R4;LINKAGE=A

¹⁵ Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$, $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\gamma\gamma) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.188 \pm 0.035)\%$, and $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^0\pi^0) \times 2B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (0.436 \pm 0.056)\%$. With the assumption of $e\mu$ universality.

NODE=M048R4;LINKAGE=C

WEIGHTED AVERAGE
2.82±0.18 (Error scaled by 1.6)



$\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{total}$ Γ_3/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.85±0.14 OUR AVERAGE				
1.82±0.09±0.12	4391	¹⁶ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16±0.39		^{17,18} BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.7 ±0.5 ±0.2	10	¹⁹ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
¹⁶ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.				
¹⁷ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.				
¹⁸ From the exclusive mode.				
¹⁹ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.				

NODE=M048R10
NODE=M048R10

NODE=M048R10;LINKAGE=BH
NODE=M048R;LINKAGE=K
NODE=M048R10;LINKAGE=M
NODE=M048R;LINKAGE=G

$\Gamma(\Upsilon(2S)\gamma\gamma)/\Gamma_{total}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502±0.0069	²⁰ BUTLER	94B CLE2	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$
²⁰ From the exclusive mode.			

NODE=M048R12
NODE=M048R12

NODE=M048R12;LINKAGE=M

$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{total}$ Γ_5/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	²¹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
²¹ Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.				

NODE=M048R25
NODE=M048R25

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{total}$ Γ_6/Γ

Abbreviation MM in the COMMENT field below stands for missing mass.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.37±0.08 OUR AVERAGE				
4.32±0.07±0.13	90k	²² LEES	11L BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	²³ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^-$ MM
4.17±0.06±0.19	6.4k	²⁴ AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	²⁵ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	²⁵ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	²⁵ BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^-X$, $\pi^+\pi^-\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

4.9 ±1.0	22	GREEN	82 CLEO	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
3.9 ±1.3	26	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²³ A weighted average of the inclusive and exclusive results.

²⁴ Using $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$, and $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

²⁵ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R3
NODE=M048R3
NODE=M048R3

NODE=M048R3;LINKAGE=LE

NODE=M048R3;LINKAGE=BH
NODE=M048R3;LINKAGE=AU

NODE=M048R3;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_2/Γ_6

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.577 ± 0.026 ± 0.060	800	²⁶ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

²⁶ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M048R28
NODE=M048R28

NODE=M048R28;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT

2.20 ± 0.13 OUR AVERAGE

2.24 ± 0.09 ± 0.11	6584	²⁷ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.99 ± 0.34	56	²⁸ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.2 ± 0.4 ± 0.3	33	²⁹ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

²⁷ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

²⁸ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.

²⁹ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$ and assuming $e\mu$ universality. Supersedes HEINTZ 91.

NODE=M048R11
NODE=M048R11

NODE=M048R11;LINKAGE=BH
NODE=M048R11;LINKAGE=B
NODE=M048R;LINKAGE=I

 $\Gamma(\Upsilon(1S)\pi^0\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_7/Γ_6

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.501 ± 0.043	³⁰ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

³⁰ Not independent of other values reported by BHARI 09.

NODE=M048R26
NODE=M048R26

NODE=M048R26;LINKAGE=BH

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.1 90 ³¹ LEES 11L BABR $\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.8	90	^{31,32} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

<0.18	90	³³ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

<2.2	90	BROCK	91 CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

³¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³² Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

³³ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R9
NODE=M048R9

NODE=M048R9;LINKAGE=LE
NODE=M048R9;LINKAGE=AU
NODE=M048R9;LINKAGE=HE

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_8/Γ_6

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT

<0.23 90 ³⁴ LEES 11L BABR $\Upsilon(3S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.9	90	³⁵ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

³⁴ Not independent of other values reported by LEES 11L.

³⁵ Not independent of other values reported by AUBERT 08BP.

NODE=M048R27
NODE=M048R27

NODE=M048R27;LINKAGE=LE
NODE=M048R27;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT

<0.07 90 ³⁶ HE 08A CLEO $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

³⁶ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M048R24
NODE=M048R24

NODE=M048R24;LINKAGE=HE

 $\Gamma(h_b(1P)\pi^0)/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 × 10⁻³ 90 ³⁷ GE 11 CLEO $\Upsilon(3S) \rightarrow \pi^0$ anything

³⁷ Assuming $M(h_b(1P)) = 9900$ MeV and $\Gamma(h_b(1P)) = 0$ MeV, and allowing $B(h_b(1P) \rightarrow \gamma\eta_b(1S))$ to vary from 0–100%.

NODE=M048R03
NODE=M048R03

NODE=M048R03;LINKAGE=GE

 $\Gamma(h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT

4.3 ± 1.1 ± 0.9 LEES 11K BABR $\Upsilon(3S) \rightarrow \eta_b\gamma\pi^0$

NODE=M048R33
NODE=M048R33

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.2	90	38 LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<18		38 BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^- X$
<15		38 BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^- X$
38 For $M(h_b(1P)) = 9900$ MeV.				

NODE=M048R34
NODE=M048R34

NODE=M048R34;LINKAGE=MH

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.29 \pm 0.21 \pm 0.22$	15k	39 BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S) \rightarrow \tau^+\tau^-$
39 BESSON 07 reports $[\Gamma(\Upsilon(3S) \rightarrow \tau^+\tau^-)/\Gamma_{\text{total}}] / [B(\Upsilon(3S) \rightarrow \mu^+\mu^-)] = 1.05 \pm 0.08 \pm 0.05$ which we multiply by our best value $B(\Upsilon(3S) \rightarrow \mu^+\mu^-) = (2.18 \pm 0.21) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M048R18
NODE=M048R18

NODE=M048R18;LINKAGE=BE

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$ Γ_{13}/Γ_{14}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.968 ± 0.016 OUR AVERAGE				
$0.966 \pm 0.008 \pm 0.014$	2.2M	LEES	20E BABR	$e^+e^- \rightarrow \Upsilon(3S)$
$1.05 \pm 0.08 \pm 0.05$	15k	BESSON	07 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

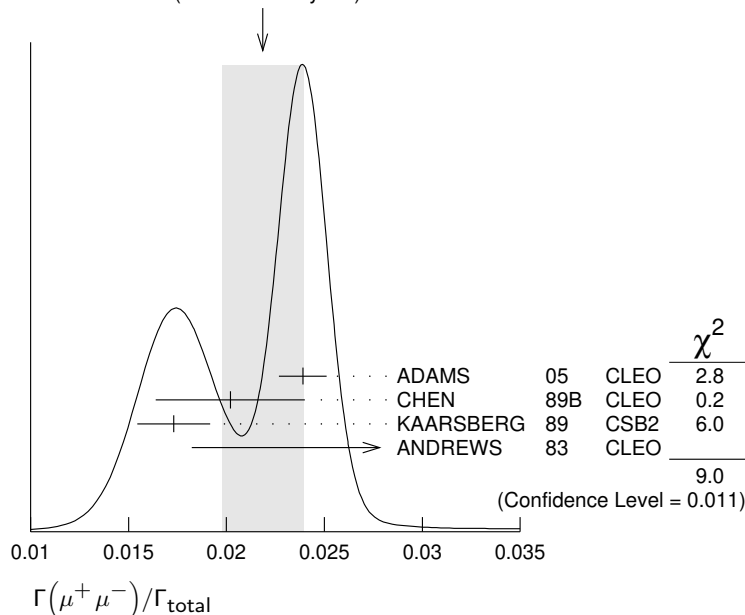
NODE=M048R19
NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0218 ± 0.0021 OUR AVERAGE				Error includes scale factor of 2.1. See the ideogram below.
$0.0239 \pm 0.0007 \pm 0.0010$	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
$0.0202 \pm 0.0019 \pm 0.0033$		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
$0.0173 \pm 0.0015 \pm 0.0011$		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
$0.033 \pm 0.013 \pm 0.007$	1096	ANDREWS	83 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$

NODE=M048R1
NODE=M048R1

WEIGHTED AVERAGE
 0.0218 ± 0.0021 (Error scaled by 2.1)


 $\Gamma(ggg)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
35.7 ± 2.6	3M	40 BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \text{hadrons}$

NODE=M048R30
NODE=M048R30

NODE=M048R30;LINKAGE=BE

40 Calculated using BESSON 06A value of $\Gamma(\gamma gg)/\Gamma(ggg) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and the PDG 08 values of $B(\Upsilon(2S) + \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+\pi^-\Upsilon(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma\chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma\chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma\chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+\mu^-) = (2.18 \pm 0.21)\%$, and $R_{\text{hadrons}} = 3.51$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ BESSON 06A value.

$\Gamma(\gamma g g)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.18	60k	⁴¹ BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

⁴¹ Calculated using BESSON 06A values of $\Gamma(\gamma g g)/\Gamma(g g g) = (2.72 \pm 0.06 \pm 0.32 \pm 0.37)\%$ and $\Gamma(g g g)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with $\Gamma(g g g)/\Gamma_{\text{total}}$ BESSON 06A value.

 Γ_{18}/Γ

NODE=M048R31
NODE=M048R31

NODE=M048R31;LINKAGE=BE

 $\Gamma(\gamma g g)/\Gamma(g g g)$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.72 ± 0.06 ± 0.49	3M	BESSON	06A CLEO	$\Upsilon(3S) \rightarrow (\gamma +) \text{hadrons}$

 Γ_{18}/Γ_{17}

NODE=M048R32
NODE=M048R32

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.33 ± 0.15^{+0.31}_{-0.28}	LEES	14G BABR	$e^+e^- \rightarrow \overline{2H} X$

 Γ_{19}/Γ

NODE=M048R00
NODE=M048R00

 $\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$

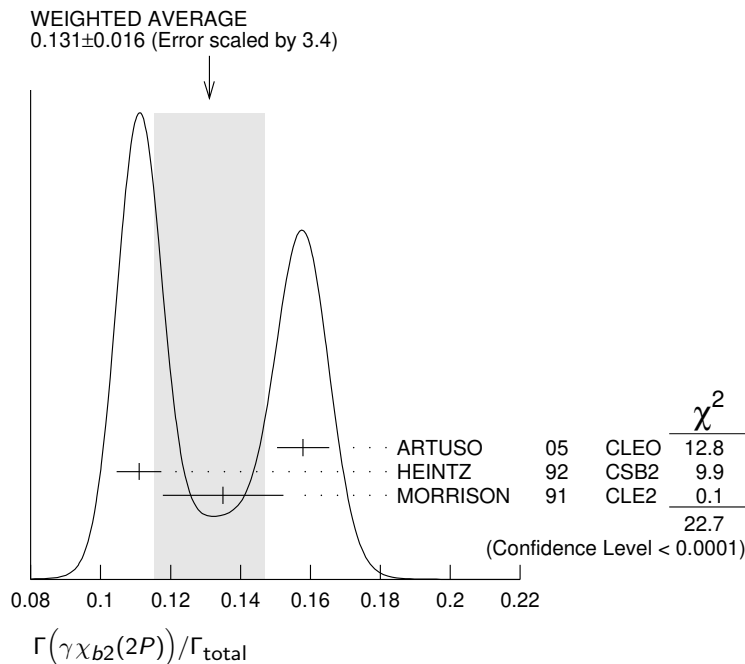
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.131 ± 0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.		
0.1579 ± 0.0017 ± 0.0073	568k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.111 ± 0.005 ± 0.004	10319	⁴² HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
0.135 ± 0.003 ± 0.017	30741	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

⁴² Supersedes NARAIN 91.

 Γ_{20}/Γ

NODE=M048R5
NODE=M048R5

NODE=M048R;LINKAGE=H

 $\Gamma(\gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$

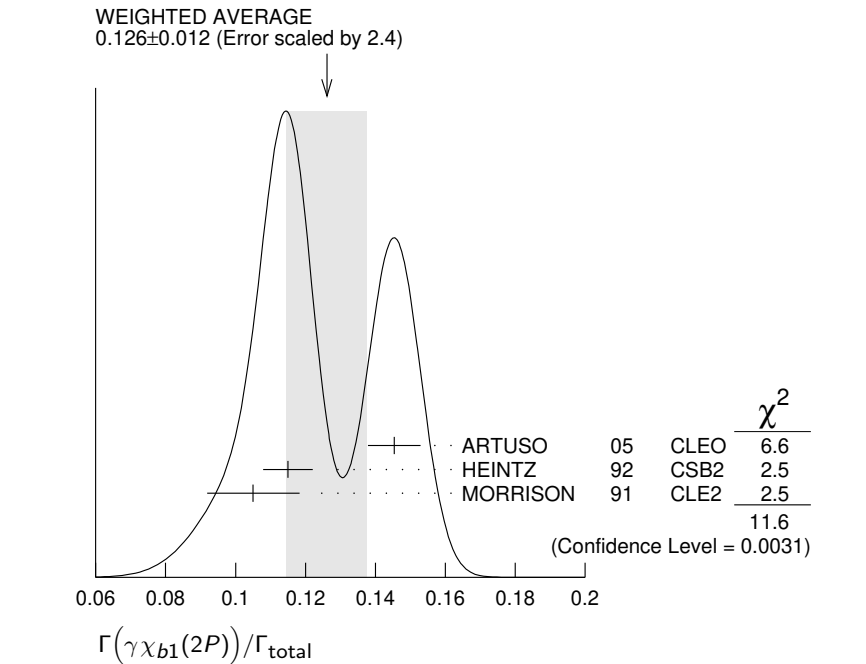
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.126 ± 0.012 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
0.1454 ± 0.0018 ± 0.0073	537k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
0.115 ± 0.005 ± 0.005	11147	⁴³ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
0.105 ^{+0.003} _{-0.002} ± 0.013	25759	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

⁴³ Supersedes NARAIN 91.

 Γ_{21}/Γ

NODE=M048R6
NODE=M048R6

NODE=M048R6;LINKAGE=H

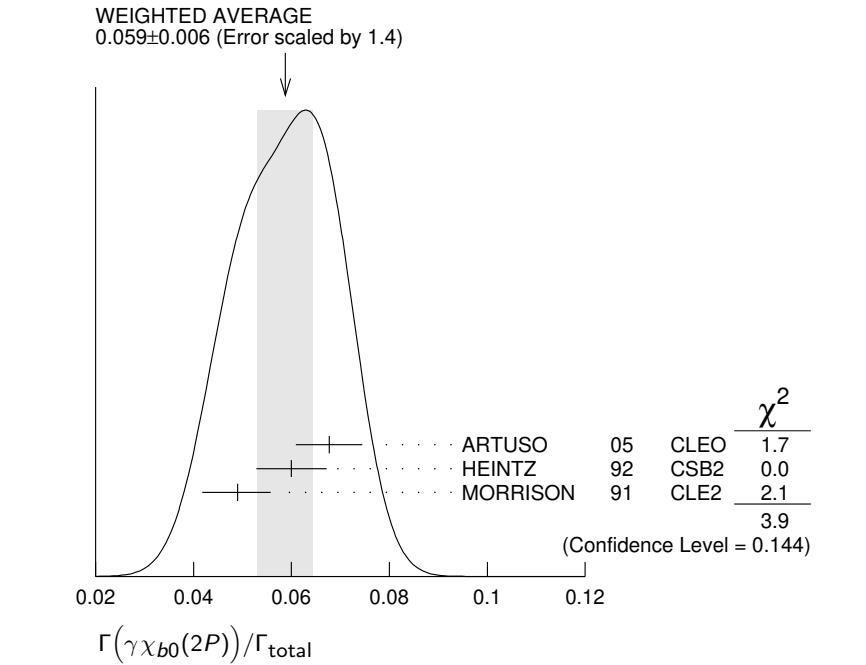


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$					Γ_{22}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.059 ±0.006 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.	
0.0677 ±0.0020 ±0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.060 ±0.004 ±0.006	4959	44 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$	
0.049 $^{+0.003}_{-0.004}$ ±0.006	9903	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$	

44 Supersedes NARAIN 91.

NODE=M048R7
NODE=M048R7

NODE=M048R7;LINKAGE=H



$\Gamma(\gamma\chi_{b2}(1P))/\Gamma_{\text{total}}$					Γ_{23}/Γ	
VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
10.0±1.0 OUR AVERAGE					Error includes scale factor of 1.7.	
8.0±1.3±0.4	126	45,46 KORNICER	11	CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$	
10.5±0.3 $^{+0.7}_{-0.6}$	9.7k	LEES	11J	BABR	$\Upsilon(3S) \rightarrow X\gamma$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<19 seen	90	47 ASNER	08A	CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$	
		48 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$	

NODE=M048R21
NODE=M048R21

⁴⁵ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁶ KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))]$
 $= (1.435 \pm 0.162 \pm 0.169) \times 10^{-3}$ which we divide by our best value $B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) = (18.0 \pm 1.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴⁷ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))]$
 $< 27.1 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

⁴⁸ HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma \Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0, 1, 2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1, 2$ using $\Upsilon(1S) \rightarrow \ell^+ \ell^-$.

NODE=M048R21;LINKAGE=KA

NODE=M048R21;LINKAGE=KR

NODE=M048R21;LINKAGE=AS

NODE=M048R21;LINKAGE=HE

$\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$

Γ_{24}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.9±0.5 OUR AVERAGE Error includes scale factor of 1.8.					
$1.5 \pm 0.4 \pm 0.1$	50	^{49,50}	KORNICER	11	CLEO $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$
$0.5 \pm 0.3^{+0.2}_{-0.1}$			LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R22
NODE=M048R22

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 1.7 seen	90	⁵¹	ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
		⁵²	HEINTZ	92	CSB2 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

⁴⁹ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁵⁰ KORNICER 11 reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))]$
 $= (5.38 \pm 1.20 \pm 0.95) \times 10^{-4}$ which we divide by our best value $B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) = (35.2 \pm 2.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵¹ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] < 2.5 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

⁵² HEINTZ 92, while unable to distinguish between different J states, measures $\sum_J B(\Upsilon(3S) \rightarrow \gamma \chi_{bJ}) \times B(\chi_{bJ} \rightarrow \gamma \Upsilon(1S)) = (1.7 \pm 0.4 \pm 0.6) \times 10^{-3}$ for $J = 0, 1, 2$ using inclusive $\Upsilon(1S)$ decays and $(1.2^{+0.4}_{-0.3} \pm 0.09) \times 10^{-3}$ for $J = 1, 2$ using $\Upsilon(1S) \rightarrow \ell^+ \ell^-$.

NODE=M048R22;LINKAGE=KA

NODE=M048R22;LINKAGE=KR

NODE=M048R22;LINKAGE=AS

NODE=M048R22;LINKAGE=HE

$\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$

Γ_{25}/Γ

VALUE (units 10^{-2})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
0.27±0.04 OUR AVERAGE					
$0.27 \pm 0.04 \pm 0.02$	2.3k		LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$
$0.30 \pm 0.04 \pm 0.10$	8.7k		ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$

NODE=M048R15
NODE=M048R15

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.8	90	⁵³	ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

⁵³ ASNER 08A reports $[\Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}] / [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] < 21.9 \times 10^{-2}$ which we multiply by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

NODE=M048R15;LINKAGE=AS

$\Gamma(\gamma \eta_b(2S))/\Gamma_{\text{total}}$

Γ_{26}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 6.2				
	90	ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 19	90	LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$

NODE=M048R16
NODE=M048R16

$\Gamma(\gamma \eta_b(1S))/\Gamma_{\text{total}}$

Γ_{27}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
5.1±0.7 OUR AVERAGE					
$7.1 \pm 1.8 \pm 1.3$	$2.3 \pm 0.5k$		⁵⁴ BONVICINI	10	CLEO $\Upsilon(3S) \rightarrow \gamma X$
$4.8 \pm 0.5 \pm 0.6$	$19 \pm 3k$		⁵⁴ AUBERT	09AQ	BABR $\Upsilon(3S) \rightarrow \gamma X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 8.5	90		LEES	11J	BABR $\Upsilon(3S) \rightarrow X \gamma$
$4.8 \pm 0.5 \pm 1.2$	$19 \pm 3k$	^{54,55}	AUBERT	08V	BABR $\Upsilon(3S) \rightarrow \gamma X$
< 4.3	90	⁵⁶	ARTUSO	05	CLEO $e^+ e^- \rightarrow \gamma X$

NODE=M048R17
NODE=M048R17

⁵⁴ Assuming $\Gamma_{\eta_b(1S)} = 10 \text{ MeV}$.

⁵⁵ Systematic error re-evaluated by AUBERT 09AQ.

⁵⁶ Superseded by BONVICINI 10.

NODE=M048R17;LINKAGE=BO

NODE=M048R17;LINKAGE=AU

NODE=M048R17;LINKAGE=SU

$\Gamma(\gamma A^0 \rightarrow \gamma \text{hadrons})/\Gamma_{\text{total}}$ (0.3 GeV < m_{A^0} < 7 GeV) Γ_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8 \times 10^{-5}$	90	⁵⁷ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

⁵⁷ For a narrow scalar or pseudoscalar, A^0 , excluding known resonances, with mass in the range 0.3–7 GeV. Measured 90% CL limits as a function of m_{A^0} range from 1×10^{-6} to 8×10^{-5} .

NODE=M048R02

 NODE=M048R02
 NODE=M048R02

NODE=M048R02;LINKAGE=LE

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ (1.5 GeV < m_X < 5.0 GeV) Γ_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.2	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M048R20

 NODE=M048R20
 NODE=M048R20
 $\Gamma(\gamma A^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.5	90	⁵⁸ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \mu^+ \mu^-$

⁵⁸ For a narrow scalar or pseudoscalar, A^0 , with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of m_{A^0} range from 0.27–5.5 $\times 10^{-6}$.

 NODE=M048R04
 NODE=M048R04

NODE=M048R04;LINKAGE=AU

 $\Gamma(\gamma A^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.6 \times 10^{-4}$	90	⁵⁹ AUBERT	09P BABR	$e^+e^- \rightarrow \gamma A^0 \rightarrow \gamma \tau^+ \tau^-$

⁵⁹ For a narrow scalar or pseudoscalar, A^0 , with $M(\tau^+ \tau^-)$ in the ranges 4.03–9.52 and 9.61–10.10 GeV. Measured 90% CL limits as a function of $M(\tau^+ \tau^-)$ range from 1.5–16 $\times 10^{-5}$.

 NODE=M048R29
 NODE=M048R29

NODE=M048R29;LINKAGE=AU

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

 $\Gamma(e^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.2	90	LEES	10B BABR	$e^+e^- \rightarrow e^\pm \tau^\mp$

NODE=M048230

 NODE=M048R01
 NODE=M048R01
 $\Gamma(e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.6 \times 10^{-7}$	90	LEES	22A BABR	$e^+e^- \rightarrow e^\pm \mu^\mp$

 NODE=M048R07
 NODE=M048R07
 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 3.1	90	LEES	10B BABR	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 20.3	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

 NODE=M048R23
 NODE=M048R23
 $\Upsilon(3S)$ REFERENCES

NODE=M048

SHAMOV	23	PL B839 137766	A.G. Shamov, O.L. Rezanova	(NOVO, NOVOU)	REFID=62012
LEES	22A	PRL 128 091804	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=61659
LEES	20E	PRL 125 241801	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=60700
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55939
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)	REFID=53960
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)	REFID=16769
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53877
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53937
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53938
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=53231
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53355
AUBERT	09AQ	PRL 103 161801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53106
AUBERT	09P	PRL 103 181801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53062
AUBERT	09Z	PRL 103 081803	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52930
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)	REFID=52662
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
AUBERT	08V	PRL 101 071801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52262
HE	08A	PRL 101 192001	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=52587
LOVE	08A	PRL 101 201601	W. Love <i>et al.</i>	(CLEO Collab.)	REFID=52592
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=51620
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)	REFID=52079

BESSON	06A	PR D74 012003	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	06	PRL 96 092003	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
ADAMS	05	PRL 94 012001	G.S. Adams <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	
BUTLER	94B	PR D49 40	F. Butler <i>et al.</i>	(CLEO Collab.)
WU	93	PL B301 307	Q.W. Wu <i>et al.</i>	(CUSB Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
BROCK	91	PR D43 1448	I.C. Brock <i>et al.</i>	(CLEO Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)
CHEN	89B	PR D39 3528	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)
BUCHMUELLER...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)
Editors: A. Ali and P. Soeding,		World Scientific, Singapore		
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)
BARU	86B	ZPHY C32 622 (errat.)	S.E. Baru <i>et al.</i>	(NOVO)
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)
		Translated from YAF 41 733.		
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)
ANDREWS	83	PRL 50 807	D.E. Andrews <i>et al.</i>	(CLEO Collab.)
GREEN	82	PRL 49 617	J. Green <i>et al.</i>	(CLEO Collab.)
MAGERAS	82	PL 118B 453	G. Mageras <i>et al.</i>	(COLU, CORN, LSU+)

REFID=51147
REFID=51035
REFID=50452
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REFID=47424
REFID=43799
REFID=43313
REFID=43604
REFID=41579
REFID=41580
REFID=41634
REFID=41586
REFID=40919
REFID=40733
REFID=40034

NODE=M206

$$\chi_{b1}(3P)$$

$$I^G(J^{PC}) = 0^+(1^{++})$$

Observed in the radiative decay to $\Upsilon(1S, 2S, 3S)$, therefore $C = +$.
 J needs confirmation.

NODE=M206

$\chi_{b1}(3P)$ MASS

NODE=M206M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10513.42 ± 0.41 ± 0.53		¹ SIRUNYAN	18N CMS	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10515.7 $\begin{smallmatrix} +2.2 \\ -3.9 \end{smallmatrix}$ $\begin{smallmatrix} +1.5 \\ -2.1 \end{smallmatrix}$	169	² AAIJ	14BG LHCb	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
10512.1 $\pm 2.1 \pm 0.9$	351	³ AAIJ	14BG LHCb	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
10511.3 $\pm 1.7 \pm 2.5$	182	⁴ AAIJ	14BI LHCb	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
10530 $\pm 5 \pm 9$		⁵ AAD	12A ATLS	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$
10551 $\pm 14 \pm 17$		⁵ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$

NODE=M206M

¹ Systematic error includes an additional 0.5 MeV for the uncertainty on the $\Upsilon(3S)$ mass. Also measures $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.60 \pm 0.64 \pm 0.17$ MeV. A total of 372 $\chi_{b1}(3P)$ and $\chi_{b2}(3P)$ events was observed.

NODE=M206M;LINKAGE=D

² From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206M;LINKAGE=A

³ The mass of the $\chi_{b1}(3P)$ state obtained by combining the results of AAIJ 14BG with that of AAIJ 14BI. The first uncertainty is experimental and the second attributable to the unknown mass splitting, assumed to be $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

NODE=M206M;LINKAGE=B

⁴ From $\chi_{b1}(3P) \rightarrow \Upsilon(3S)\gamma$ transition assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV.

NODE=M206M;LINKAGE=C

⁵ The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.

NODE=M206M;LINKAGE=AA

$\chi_{b1}(3P)$ DECAY MODES

NODE=M206215;NODE=M206

Mode	Fraction (Γ_i/Γ)
Γ_1 $\Upsilon(1S)\gamma$	seen
Γ_2 $\Upsilon(2S)\gamma$	seen
Γ_3 $\Upsilon(3S)\gamma$	seen

DESIG=1

DESIG=2

DESIG=3

$\chi_{b1}(3P)$ BRANCHING RATIOS

NODE=M206225

$\Gamma(\Upsilon(1S)\gamma)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	169	¹ AAIJ	14BG LHCb	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		AAD	12A ATLS	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	
seen		ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M206R01

NODE=M206R01

¹ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.

NODE=M206R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\gamma)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	169	¹ AAIJ	14BG LHCb	$pp \rightarrow \gamma \mu^+ \mu^- X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		AAD	12A ATLAS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
¹ From $\chi_{b1}(3P) \rightarrow \Upsilon(1S, 2S)\gamma$ transitions assuming $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.5 \pm 1.5$ MeV and allowing for $\pm 30\%$ variation in the $\chi_{b2}(3P)$ production rate relative to that of $\chi_{b1}(3P)$.					

NODE=M206R02
NODE=M206R02

NODE=M206R02;LINKAGE=A

$\Gamma(\Upsilon(3S)\gamma)/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen		SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
seen	182	AAIJ	14BI LHCb	$pp \rightarrow \gamma \mu^+ \mu^- X$	

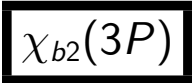
NODE=M206R03
NODE=M206R03

$\chi_{b1}(3P)$ REFERENCES

SIRUNYAN	18N	PRL 121 092002	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	14BG	JHEP 1410 088	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14BI	EPJ C74 3092	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)
ABAZOV	12Q	PR D86 031103	V.M. Abazov <i>et al.</i>	(D0 Collab.)

NODE=M206

REFID=58873
REFID=56199
REFID=56235
REFID=54037
REFID=54264



$I^G(J^{PC}) = 0^+(2^{++})$

Observed in the radiative decay to $\Upsilon(3S)$, therefore $C = +$. J needs confirmation.

NODE=M238

NODE=M238

$\chi_{b2}(3P)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10524.02$\pm$0.57$\pm$0.53	¹ SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10530 $\pm$ 5 $\pm$ 9	² AAD	12A ATLAS	$pp \rightarrow \gamma \mu^+ \mu^- X$
¹ Systematic error includes an additional 0.5 MeV for the uncertainty on the $\Upsilon(3S)$ mass. Also measures $m_{\chi_{b2}(3P)} - m_{\chi_{b1}(3P)} = 10.60 \pm 0.64 \pm 0.17$ MeV. A total of 372 $\chi_{b1}(3P)$ and $\chi_{b2}(3P)$ events was observed.			
² The mass barycenter of the merged lineshapes from the $J = 1$ and 2 states.			

NODE=M238M

NODE=M238M

NODE=M238M;LINKAGE=A

NODE=M238M;LINKAGE=AA

$\chi_{b2}(3P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(3S)\gamma$	seen

DESIG=1

$\chi_{b2}(3P)$ BRANCHING RATIOS

$\Gamma(\Upsilon(3S)\gamma)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$	

NODE=M238225

NODE=M238R01
NODE=M238R01

$\chi_{b2}(3P)$ REFERENCES

SIRUNYAN	18N	PRL 121 092002	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAD	12A	PRL 108 152001	G. Aad <i>et al.</i>	(ATLAS Collab.)

NODE=M238

REFID=58873
REFID=54037

$\Upsilon(4S)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

also known as $\Upsilon(10580)$

NODE=M047

 $\Upsilon(4S)$ MASS

NODE=M047M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10579.4±1.2 OUR AVERAGE			
10579.3±0.4±1.2	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
10580.0±3.5	¹ BEBEK	87 CLEO	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10577.4±1.0	² LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons
¹ Reanalysis of BESSON 85.			
² No systematic error given.			

NODE=M047M

NODE=M047M;LINKAGE=C
NODE=M047M;LINKAGE=B **$\Upsilon(4S)$ WIDTH**

NODE=M047W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
20.5±2.5 OUR AVERAGE			
20.7±1.6±2.5	AUBERT	05Q BABR	$e^+e^- \rightarrow$ hadrons
20 ±2 ±4	BESSON	85 CLEO	$e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •			
25 ±2.5	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

NODE=M047W

 $\Upsilon(4S)$ DECAY MODES

NODE=M047215;NODE=M047

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}$	> 96 %	95%
Γ_2 B^+B^-	(51.4 ±0.6) %	
Γ_3 D^+_S anything + c.c.	(17.8 ±2.6) %	
Γ_4 $B^0\bar{B}^0$	(48.6 ±0.6) %	
Γ_5 $J/\psi K^0_S + (J/\psi, \eta_c) K^0_S$	< 4 × 10 ⁻⁷	90%
Γ_6 non- $B\bar{B}$	< 4 %	95%
Γ_7 e^+e^-	(1.57±0.08) × 10 ⁻⁵	
Γ_8 $\rho^+\rho^-$	< 5.7 × 10 ⁻⁶	90%
Γ_9 $K^*(892)^0\bar{K}^0$	< 2.0 × 10 ⁻⁶	90%
Γ_{10} $J/\psi(1S)$ anything	< 1.9 × 10 ⁻⁴	95%
Γ_{11} D^{*+} anything + c.c.	< 7.4 %	90%
Γ_{12} ϕ anything	(7.1 ±0.6) %	
Γ_{13} $\phi\eta$	< 1.8 × 10 ⁻⁶	90%
Γ_{14} $\phi\eta'$	< 4.3 × 10 ⁻⁶	90%
Γ_{15} $\rho\eta$	< 1.3 × 10 ⁻⁶	90%
Γ_{16} $\rho\eta'$	< 2.5 × 10 ⁻⁶	90%
Γ_{17} $\Upsilon(1S)$ anything	< 4 × 10 ⁻³	90%
Γ_{18} $\Upsilon(1S)\pi^+\pi^-$	(8.2 ±0.4) × 10 ⁻⁵	
Γ_{19} $\Upsilon(1S)\eta$	(1.81±0.18) × 10 ⁻⁴	
Γ_{20} $\Upsilon(1S)\eta'$	(3.4 ±0.9) × 10 ⁻⁵	
Γ_{21} $\Upsilon(2S)\pi^+\pi^-$	(8.2 ±0.8) × 10 ⁻⁵	
Γ_{22} $h_b(1P)\pi^+\pi^-$	not seen	
Γ_{23} $h_b(1P)\eta$	(2.18±0.21) × 10 ⁻³	
Γ_{24} $\eta_b(1S)\omega$	< 1.8 × 10 ⁻⁴	90%
Γ_{25} ^2H anything	< 1.3 × 10 ⁻⁵	90%

DESIG=8;OUR EST;→ UNCHECKED ←

DESIG=10

DESIG=12

DESIG=11

DESIG=15

DESIG=6

DESIG=1

DESIG=16

DESIG=22

DESIG=2

DESIG=3

DESIG=4

DESIG=13

DESIG=18

DESIG=19

DESIG=20

DESIG=5

DESIG=7

DESIG=17

DESIG=26

DESIG=9

DESIG=21

DESIG=23

DESIG=27

DESIG=14

Double Radiative Decays

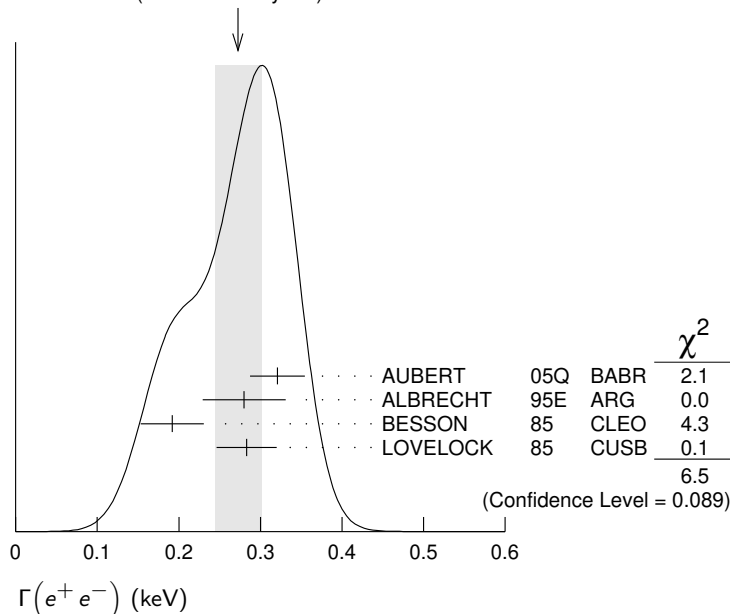
Γ_{26} $\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S)$	< 2.3 × 10 ⁻⁵	90%

NODE=M047;CLUMP=B

DESIG=24

$\Upsilon(4S)$ PARTIAL WIDTHS **$\Gamma(e^+e^-)$** **Γ_7**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.272 ± 0.029 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
$0.321 \pm 0.017 \pm 0.029$	AUBERT	05Q BABR	$e^+e^- \rightarrow \text{hadrons}$
$0.28 \pm 0.05 \pm 0.01$	¹ ALBRECHT	95E ARG	$e^+e^- \rightarrow \text{hadrons}$
$0.192 \pm 0.007 \pm 0.038$	BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$
0.283 ± 0.037	LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$

¹ Using LEYAOUANC 77 parametrization of $\Gamma(s)$.WEIGHTED AVERAGE
 0.272 ± 0.029 (Error scaled by 1.5)

NODE=M047220

NODE=M047W1
NODE=M047W1

NODE=M047W1;LINKAGE=A

 $\Upsilon(4S)$ BRANCHING RATIOS **$B\bar{B}$ DECAYS**

The ratio of branching fraction to charged and neutral B mesons is often derived assuming isospin invariance in the decays, and relies on the knowledge of the B^+/B^0 lifetime ratio. "OUR EVALUATION" is obtained based on averages of rescaled data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>. The averaging/rescaling procedure takes into account the common dependence of the measurement on the value of the lifetime ratio.

NODE=M047230

NODE=M047BBD

NODE=M047BBD

 $\Gamma(B^+B^-)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	DOCUMENT ID
0.514 ± 0.006 OUR EVALUATION	(Produced by HFLAV) Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$

NODE=M047R11
NODE=M047R11
→ UNCHECKED ← **$\Gamma(D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
$0.178 \pm 0.021 \pm 0.016$	¹ ARTUSO	05B CLE3	$e^+e^- \rightarrow D_s^+ X$
¹ ARTUSO 05B reports $[\Gamma(\Upsilon(4S) \rightarrow D_s^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = (8.0 \pm 0.2 \pm 0.9) \times 10^{-3}$ which we divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M047R13
NODE=M047R13

NODE=M047R13;LINKAGE=AR

 $\Gamma(B^0\bar{B}^0)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
0.486 ± 0.006 OUR EVALUATION	Assuming $B(\Upsilon(4S) \rightarrow B\bar{B}) = 1$		
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$0.487 \pm 0.010 \pm 0.008$	¹ AUBERT,B	05H BABR	$\Upsilon(4S) \rightarrow \bar{B}B \rightarrow D^* \ell \nu_\ell$

NODE=M047R12
NODE=M047R12
→ UNCHECKED ←

¹ Direct measurement. This value is averaged with the value extracted from the $\Gamma(B^+ B^-)$ / $\Gamma(B^0 \bar{B}^0)$ measurements.

NODE=M047R12;LINKAGE=AU

$\Gamma(B^+ B^-)/\Gamma(B^0 \bar{B}^0)$

Γ_2/Γ_4

VALUE	DOCUMENT ID	TECN	COMMENT

1.058 ± 0.024 OUR EVALUATION

Average is meaningless. [1.031 ± 0.033 OUR 2023 AVERAGE]

1.065 ± 0.012 ± 0.051	¹ CHOUDHURY 23	BELL	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.006 ± 0.036 ± 0.031	² AUBERT 04F	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.01 ± 0.03 ± 0.09	² HASTINGS 03	BELL	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow \text{dileptons}$
1.058 ± 0.084 ± 0.136	³ ATHAR 02	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow D^* \ell \nu$
1.10 ± 0.06 ± 0.05	⁴ AUBERT 02	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow (c\bar{c}) K^*$
1.04 ± 0.07 ± 0.04	⁵ ALEXANDER 01	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

¹ CHOUDHURY 23 includes uncertainty due to the isospin symmetry assumption in $B \rightarrow J/\psi K$ decays.

² HASTINGS 03 and AUBERT 04F assume $\tau(B^+) / \tau(B^0) = 1.083 \pm 0.017$.

³ ATHAR 02 assumes $\tau(B^+) / \tau(B^0) = 1.074 \pm 0.028$. Supersedes BARISH 95.

⁴ AUBERT 02 assumes $\tau(B^+) / \tau(B^0) = 1.062 \pm 0.029$.

⁵ ALEXANDER 01 assumes $\tau(B^+) / \tau(B^0) = 1.066 \pm 0.024$.

NODE=M047R10
NODE=M047R10
→ UNCHECKED ←

NODE=M047R10;LINKAGE=A

NODE=M047R10;LINKAGE=F
NODE=M047R10;LINKAGE=D
NODE=M047R10;LINKAGE=E
NODE=M047R10;LINKAGE=C

$[\Gamma(J/\psi K_S^0) + \Gamma((J/\psi, \eta_c) K_S^0)]/\Gamma_{\text{total}}$

Γ_5/Γ

Forbidden by CP invariance.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT

<4	90	¹ TAJIMA 07A	BELL	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0$

¹ $\Upsilon(4S)$ with $CP = +1$ decays to the final state with $CP = -1$.

NODE=M047R16
NODE=M047R16
NODE=M047R16

NODE=M047R16;LINKAGE=TA

NODE=M047NBB

non- $B\bar{B}$ DECAYS

$\Gamma(\text{non-}B\bar{B})/\Gamma_{\text{total}}$

Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.04	95	BARISH 96B	CLEO	$e^+ e^-$

NODE=M047R6
NODE=M047R6

$\Gamma(e^+ e^-)/\Gamma_{\text{total}}$

Γ_7/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT

1.57 ± 0.08 OUR AVERAGE

1.55 ± 0.04 ± 0.07	AUBERT 05Q	BABR	$e^+ e^- \rightarrow \text{hadrons}$
2.77 ± 0.50 ± 0.49	¹ ALBRECHT 95E	ARG	$e^+ e^- \rightarrow \text{hadrons}$

¹ Using LEYAOQUANC 77 parametrization of $\Gamma(s)$.

NODE=M047R5
NODE=M047R5

NODE=M047R5;LINKAGE=A

$\Gamma(\rho^+ \rho^-)/\Gamma_{\text{total}}$

Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.7 × 10 ⁻⁶	90	AUBERT 08BO	BABR	$e^+ e^- \rightarrow \pi^+ \pi^- 2\pi^0$

NODE=M047R17
NODE=M047R17

$\Gamma(K^*(892)^0 \bar{K}^0)/\Gamma_{\text{total}}$

Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.0 × 10 ⁻⁶	90	SHEN 13A	BELL	$e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M047R02
NODE=M047R02

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_{10}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT

<1.9	95	¹ ABE 02D	BELL	$e^+ e^- \rightarrow J/\psi X \rightarrow \ell^+ \ell^- X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<4.7	90	¹ AUBERT 01C	BABR	$e^+ e^- \rightarrow J/\psi X \rightarrow \ell^+ \ell^- X$

¹ Uses $B(J/\psi \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$ and $B(J/\psi \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010$.

NODE=M047R1
NODE=M047R1

NODE=M047R;LINKAGE=AC

$\Gamma(D^{*+} \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.074	90	¹ ALEXANDER 90C	CLEO	$e^+ e^-$

¹ For $x > 0.473$.

NODE=M047R2
NODE=M047R2

NODE=M047R2;LINKAGE=A

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$

Γ_{12}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT

7.1 ± 0.1 ± 0.6		HUANG 07	CLEO	$\Upsilon(4S) \rightarrow \phi X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.23	90	¹ ALEXANDER 90C	CLEO	$e^+ e^-$

¹ For $x > 0.52$.

NODE=M047R3
NODE=M047R3

NODE=M047R3;LINKAGE=A

$\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \phi\eta$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.5	90	AUBERT,BE 06F	BABR	$e^+e^- \rightarrow \phi\eta$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R14
NODE=M047R14

NODE=M047R14;LINKAGE=BE

 $\Gamma(\phi\eta')/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<4.3	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \phi\eta'$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R21
NODE=M047R21

NODE=M047R21;LINKAGE=BE

 $\Gamma(\rho\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \rho\eta$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R22
NODE=M047R22

NODE=M047R22;LINKAGE=BE

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.5	90	¹ BELOUS 09	BELL	$e^+e^- \rightarrow \rho\eta'$

¹ Using all intermedite branching fraction values from PDG 08.

NODE=M047R23
NODE=M047R23

NODE=M047R23;LINKAGE=BE

 $\Gamma(\Upsilon(1S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.004	90	ALEXANDER 90C	CLEO	e^+e^-

NODE=M047R4
NODE=M047R4

 $\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.2 ± 0.4 OUR AVERAGE					
8.2 ± 0.5 ± 0.4		515	GUIDO 17	BELL	$\Upsilon(4S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
8.5 ± 1.3 ± 0.1	113 ± 16		¹ SOKOLOV 09	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
8.00 ± 0.64 ± 0.27	430		² AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17.8 ± 4.0 ± 0.3			^{3,4} SOKOLOV 07	BELL	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
9.0 ± 1.5 ± 0.2	167 ± 19		⁵ AUBERT 06R	BABR	$e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-$
<12	90		GLENN 99	CLE2	e^+e^-

¹ SOKOLOV 09 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (0.211 \pm 0.030 \pm 0.014) \times 10^{-5}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³ SOKOLOV 07 reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (4.42 \pm 0.81 \pm 0.56) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ According to the authors, systematic errors were underestimated.

⁵ Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(1S) \rightarrow \mu^+\mu^-)] = (2.23 \pm 0.25 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.04) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R7
NODE=M047R7

NODE=M047R7;LINKAGE=SK

NODE=M047R7;LINKAGE=UB

NODE=M047R7;LINKAGE=SO

NODE=M047R7;LINKAGE=US
NODE=M047R7;LINKAGE=AU

 $\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.81 ± 0.18 OUR AVERAGE					
1.70 ± 0.23 ± 0.08	49		GUIDO 17	BELL	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\mu^+\mu^-$
1.96 ± 0.26 ± 0.09	56		¹ AUBERT 08BP	BABR	$\Upsilon(4S) \rightarrow \pi^+\pi^-\pi^0\ell^+\ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<2.7	90	² TAMPONI 15	BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$

¹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

NODE=M047R18
NODE=M047R18

NODE=M047R18;LINKAGE=UB

NODE=M047R18;LINKAGE=A

$\Gamma(\Upsilon(1S)\eta')/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.43 \pm 0.88 \pm 0.21$	27	GUIDO	18	BELL $\Upsilon(4S) \rightarrow (\rho^0 \gamma, \pi^+ \pi^- \eta) \mu^+ \mu^-$

 Γ_{20}/Γ

NODE=M047R03
 NODE=M047R03

 $\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{19}/Γ_{18}

NODE=M047R19
 NODE=M047R19

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.41 \pm 0.40 \pm 0.12$ 56 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- (\pi^0) \ell^+ \ell^-$

¹ Not independent of other values reported by AUBERT 08BP.

NODE=M047R19;LINKAGE=UB

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{21}/Γ

NODE=M047R9
 NODE=M047R9

8.2 ± 0.8 OUR AVERAGE

$7.9 \pm 1.0 \pm 0.4$ 181 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$

$8.6 \pm 1.1 \pm 0.7$ 220 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$8.8 \pm 1.7 \pm 0.8$ 97 ± 15 ² AUBERT 06R BABR $e^+ e^- \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
 < 3.9 90 GLENN 99 CLE2 $e^+ e^-$

¹ Using $B(\Upsilon(2S) \rightarrow e^+ e^-) = (1.91 \pm 0.16)\%$ and $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

NODE=M047R9;LINKAGE=UB

² Superseded by AUBERT 08BP. AUBERT 06R reports $[\Gamma(\Upsilon(4S) \rightarrow \Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \mu^+ \mu^-)] = (1.69 \pm 0.26 \pm 0.20) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M047R9;LINKAGE=AU

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{21}/Γ_{18}

NODE=M047R20
 NODE=M047R20

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.16 \pm 0.16 \pm 0.14$ 220 ¹ AUBERT 08BP BABR $\Upsilon(4S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

¹ Using $B(\Upsilon(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$, $B(\Upsilon(2S) \rightarrow e^+ e^-) = (1.91 \pm 0.16)\%$, and $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$. Not independent of other values reported by AUBERT 08BP.

NODE=M047R20;LINKAGE=UB

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{22}/Γ

NODE=M047R01
 NODE=M047R01

not seen $(35^{+32}_{-26})k$ ¹ ADACHI 12 BELL $10.58 e^+ e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹ From the upper limit on the ratio of $\sigma(e^+ e^- \rightarrow h_b(1P)\pi^+\pi^-)$ at the $\Upsilon(4S)$ to that at the $\Upsilon(5S)$ of 0.27.

NODE=M047R01;LINKAGE=AD

 $\Gamma(h_b(1P)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

 Γ_{23}/Γ

NODE=M047R00
 NODE=M047R00

$2.18 \pm 0.11 \pm 0.18$ 112k ¹ TAMPONI 15 BELL $e^+ e^- \rightarrow h_b(1P)\eta$

¹ Using $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

NODE=M047R00;LINKAGE=A

 $\Gamma(\eta_b(1S)\omega)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

 Γ_{24}/Γ

NODE=M047R04
 NODE=M047R04

$< 1.8 \times 10^{-4}$ 90 OSKIN 20 BELL $e^+ e^- \rightarrow \omega X$

 $\Gamma(\eta_b(1S)\omega)/\Gamma(h_b(1P)\eta)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

 Γ_{24}/Γ_{23}

NODE=M047R05
 NODE=M047R05

$< 8.4 \times 10^{-2}$ 90 ¹ OSKIN 20 BELL $e^+ e^- \rightarrow \omega X$

¹ Using $B(\Upsilon(4S) \rightarrow h_b(1P)\eta) = (2.18 \pm 0.11 \pm 0.18) \times 10^{-3}$ from TAMPONI 15.

NODE=M047R05;LINKAGE=A

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT

 Γ_{25}/Γ

NODE=M047R15
 NODE=M047R15

< 1.3 90 ASNER 07 CLEO $e^+ e^- \rightarrow \overline{d} X$

Double Radiative Decays

NODE=M047240

 $\Gamma(\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

 Γ_{26}/Γ

NODE=M047R24
 NODE=M047R24

$< 2.3 \times 10^{-5}$ 90 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \gamma\gamma\pi^+\pi^-\pi^0\mu^+\mu^-$

$\Upsilon(4S)$ REFERENCES

CHOUDHURY	23	PR D107 L031102	S. Choudhury <i>et al.</i>	(BELLE Collab.)	REFID=62074
OSKIN	20	PR D102 092011	P. Oskin <i>et al.</i>	(BELLE Collab.)	REFID=60735
GUIDO	18	PRL 121 062001	E. Guido <i>et al.</i>	(BELLE Collab.)	REFID=58860
GUIDO	17	PR D96 052005	E. Guido <i>et al.</i>	(BELLE Collab.)	REFID=58218
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=56996
SHEN	13A	PR D88 052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=55591
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)	REFID=53962
BELOUS	09	PL B681 400	K. Belous <i>et al.</i>	(BELLE Collab.)	REFID=53107
SOKOLOV	09	PR D79 051103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=52760
AUBERT	08BO	PR D78 071103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52659
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52660
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)	REFID=52166
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=51624
SOKOLOV	07	PR D75 071103	A. Sokolov <i>et al.</i>	(BELLE Collab.)	REFID=51715
TAJIMA	07A	PRL 99 211601	O. Tajima <i>et al.</i>	(BELLE Collab.)	REFID=52066
AUBERT	06R	PRL 96 232001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51143
AUBERT,BE	06F	PR D74 111103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51563
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50992
AUBERT	05Q	PR D72 032005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50774
AUBERT,B	05H	PRL 95 042001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50777
AUBERT	04F	PR D69 071101	B. Aubert <i>et al.</i>		REFID=49748
HASTINGS	03	PR D67 052004	N.C. Hastings <i>et al.</i>	(BELLE Collab.)	REFID=49209
ABE	02D	PRL 88 052001	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=48557
ATHAR	02	PR D66 052003	S.B. Athar <i>et al.</i>	(CLEO Collab.)	REFID=48832
AUBERT	02	PR D65 032001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48514
ALEXANDER	01	PRL 86 2737	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48316
AUBERT	01C	PRL 87 162002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=48346
GLENN	99	PR D59 052003	S. Glenn <i>et al.</i>		REFID=46890
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44693
ALBRECHT	95E	ZPHY C65 619	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=44372
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)	REFID=44139
ALEXANDER	90C	PRL 64 2226	J. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=41346
BEBEK	87	PR D36 1289	C. Bebek <i>et al.</i>	(CLEO Collab.)	REFID=40270
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22368
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)	REFID=22369
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)	REFID=44695

NODE=M047

 $\Upsilon(10753)$

$$I^G(J^{PC}) = ?(1^{--})$$

OMITTED FROM SUMMARY TABLEA candidate for $\Upsilon(3D)$ state or an exotic structure.

NODE=M243

Seen by MIZUK 19 in $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ($n=1,2,3$) with a significance of 5.2 σ .

 $\Upsilon(10753)$ MASS

NODE=M243M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$10752.7 \pm 5.9^{+0.7}_{-1.1}$	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10761 ± 2	² DONG	20A	$e^+e^- \rightarrow b\bar{b}$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M243M;LINKAGE=A

NODE=M243M;LINKAGE=B

 $\Upsilon(10753)$ WIDTH

NODE=M243W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$35.5^{+17.6+3.9}_{-11.3-3.3}$	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
48.5 ± 3.0	² DONG	20A	$e^+e^- \rightarrow b\bar{b}$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M243W;LINKAGE=A

NODE=M243W;LINKAGE=B

$\Upsilon(10753)$ DECAY MODES

NODE=M243215;NODE=M243

Mode	
Γ_1	$\Upsilon(1S)\pi^+\pi^-$
Γ_2	$\Upsilon(2S)\pi^+\pi^-$
Γ_3	$\Upsilon(3S)\pi^+\pi^-$
Γ_4	$\omega\chi_{b1}(1P)$
Γ_5	$\omega\chi_{b2}(1P)$
Γ_6	e^+e^-

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=2

 $\Upsilon(10753) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M243225

 $\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_1\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

NODE=M243R00
NODE=M243R00

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.295 $\pm$ 0.175 1,2 MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M243R00;LINKAGE=A

² Reported as the range 0.12–0.47 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R00;LINKAGE=B

 $\Gamma(\Upsilon(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_2\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

NODE=M243R02
NODE=M243R02

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.875 $\pm$ 0.345 1,2 MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M243R02;LINKAGE=A

² Reported as the range 0.53–1.22 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R02;LINKAGE=B

 $\Gamma(\Upsilon(3S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_3\Gamma_6/\Gamma$**

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

NODE=M243R03
NODE=M243R03

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.235 $\pm$ 0.025 1,2 MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.63\text{--}11.02$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M243R03;LINKAGE=A

² Reported as the range 0.21–0.26 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M243R03;LINKAGE=B

 $\Gamma(\omega\chi_{b1}(1P)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_4\Gamma_6/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M243R05
NODE=M243R050.63 $\pm$ 0.39 $\pm$ 0.20 68 1 ADACHI 23 BELL $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$ ¹ A fit solution with constructive interference. The other solution corresponding to destructive interference gives a value of $2.01 \pm 0.38 \pm 0.76$ eV.

NODE=M243R05;LINKAGE=A

 $\Gamma(\omega\chi_{b2}(1P)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ **$\Gamma_5\Gamma_6/\Gamma$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M243R06
NODE=M243R060.53 $\pm$ 0.46 $\pm$ 0.15 68 1 ADACHI 23 BELL $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$ ¹ A fit solution with constructive interference. The other solution corresponding to destructive interference gives a value of $1.32 \pm 0.44 \pm 0.55$ eV.

NODE=M243R06;LINKAGE=A

 $\Upsilon(10753)$ REFERENCES

NODE=M243

ADACHI	23	PRL 130 091902	I. Adachi <i>et al.</i>	(BELLE II Collab.)
DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>	
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=62210
REFID=60595
REFID=60090
REFID=57121
REFID=52661

$\Upsilon(10860)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

NODE=M092

 $\Upsilon(10860)$ MASS

NODE=M092M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10885.2^{+2.6}_{-1.6} OUR AVERAGE			
10885.3 ^{+1.5} _{-0.9}	1 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
10884.7 ^{+3.6} _{-3.4}	2 MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P,2P)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10882 ^{±1}	3 DONG	20A	$e^+e^- \rightarrow b\bar{b}$
10881.8 ^{+1.0} _{-1.1}	4,5 SANTEL	16	BELL $e^+e^- \rightarrow \text{hadrons}$
10891.1 ^{+3.2} _{-2.0}	6,7 SANTEL	16	BELL $e^+e^- \rightarrow \Upsilon(1S,2S,3S)\pi^+\pi^-$
10879 ^{±3}	8,9 CHEN	10	BELL $e^+e^- \rightarrow \text{hadrons}$
10888.4 ^{+2.7} _{-2.6}	10 CHEN	10	BELL $e^+e^- \rightarrow \Upsilon(1S,2S,3S)\pi^+\pi^-$
10876 ^{±2}	8 AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
10869 ^{±2}	11 AUBERT	09E	BABR $e^+e^- \rightarrow \text{hadrons}$
10868 ^{±6 ±5}	12 BESSON	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
10845 ^{±20}	13 LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

NODE=M092M

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M092M;LINKAGE=E

NODE=M092M;LINKAGE=D

NODE=M092M;LINKAGE=H

NODE=M092M;LINKAGE=A

NODE=M092M;LINKAGE=B

NODE=M092M;LINKAGE=C

NODE=M092M;LINKAGE=F

NODE=M092M;LINKAGE=AU

NODE=M092M;LINKAGE=CH

NODE=M092M;LINKAGE=CE

NODE=M092M;LINKAGE=UB

NODE=M092M;LINKAGE=BE

NODE=M092M;LINKAGE=LO

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

⁷ Superseded by MIZUK 19.

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

¹⁰ In a model where a flat nonresonant $\Upsilon(1S,2S,3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

¹² Assuming four Gaussians with radiative tails and a single step in R .

¹³ In a coupled-channel model with three resonances and a smooth step in R .

 $\Upsilon(10860)$ WIDTH

NODE=M092W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
37^{±4} OUR AVERAGE			
36.6 ^{+4.5} _{-3.9}	1 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
40.6 ^{+12.7} _{-8.0}	2 MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P,2P)\pi^+\pi^-$

NODE=M092W

• • • We do not use the following data for averages, fits, limits, etc. • • •

49.5 ± 1.5	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$	
48.5 ^{+1.9+2.0} _{-1.8-2.8}	4,5 SANTEL	16 BELL	$e^+e^- \rightarrow \text{hadrons}$	
53.7 ^{+7.1+1.3} _{-5.6-5.4}	6,7 SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$	OCCUR=2
46 ⁺⁹ ₋₇	8,9 CHEN	10 BELL	$e^+e^- \rightarrow \text{hadrons}$	
30.7 ^{+8.3} _{-7.0} ± 3.1	¹⁰ CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$	OCCUR=2
43 ± 4	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$	
74 ± 4	¹¹ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$	OCCUR=2
112 ± 17 ± 23	¹² BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$	
110 ± 15	¹³ LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$	
¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.				NODE=M092W;LINKAGE=F
² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.				NODE=M092W;LINKAGE=D
³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.				NODE=M092W;LINKAGE=G
⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).				NODE=M092W;LINKAGE=A
⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.				NODE=M092W;LINKAGE=B
⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.				NODE=M092W;LINKAGE=C
⁷ Superseded by MIZUK 19.				NODE=M092W;LINKAGE=E
⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.				NODE=M092W;LINKAGE=AU
⁹ The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.				NODE=M092W;LINKAGE=CH
¹⁰ In a model where a flat nonresonant $\Upsilon(1S, 2S, 3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.				NODE=M092W;LINKAGE=CE
¹¹ In a model where a non-resonant $b\bar{b}$ -continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.				NODE=M092W;LINKAGE=UB
¹² Assuming four Gaussians with radiative tails and a single step in R .				NODE=M092W;LINKAGE=BE
¹³ In a coupled-channel model with three resonances and a smooth step in R .				NODE=M092W;LINKAGE=LO

$\Upsilon(10860)$ DECAY MODES

NODE=M092215;NODE=M092

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $B\bar{B}X$	(76.2 ^{+2.7} _{-4.0}) %	DESIG=9
Γ_2 $B\bar{B}$	(5.5 ± 1.0) %	DESIG=2
Γ_3 $B\bar{B}^* + \text{c.c.}$	(13.7 ± 1.6) %	DESIG=3
Γ_4 $B^*\bar{B}^*$	(38.1 ± 3.4) %	DESIG=4
Γ_5 $B\bar{B}^{(*)}\pi$	< 19.7 %	90% DESIG=10
Γ_6 $B\bar{B}\pi$	(0.0 ± 1.2) %	DESIG=23
Γ_7 $B^*\bar{B}\pi + B\bar{B}^*\pi$	(7.3 ± 2.3) %	DESIG=24
Γ_8 $B^*\bar{B}^*\pi$	(1.0 ± 1.4) %	DESIG=25
Γ_9 $B\bar{B}\pi\pi$	< 8.9 %	90% DESIG=11
Γ_{10} $B_s^{(*)}\bar{B}_s^{(*)}$	(20.1 ± 3.1) %	DESIG=16
Γ_{11} $B_s\bar{B}_s$	(5 ± 5) × 10 ⁻³	DESIG=5
Γ_{12} $B_s\bar{B}_s^* + \text{c.c.}$	(1.35 ± 0.32) %	DESIG=7
Γ_{13} $B_s^*\bar{B}_s^*$	(17.6 ± 2.7) %	DESIG=8
Γ_{14} no open-bottom	(3.8 ^{+5.0} _{-0.5}) %	DESIG=28

Γ_{15}	e^+e^-	$(8.3 \pm 2.1) \times 10^{-6}$		DESIG=1
Γ_{16}	$K^*(892)^0 \bar{K}^0$	$< 1.0 \times 10^{-5}$	90%	DESIG=29
Γ_{17}	$\Upsilon(1S)\pi^+\pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$		DESIG=17
Γ_{18}	$\Upsilon(1S)\eta$	$(8.5 \pm 1.7) \times 10^{-4}$		DESIG=44
Γ_{19}	$\Upsilon(1S)\eta'$	$< 6.9 \times 10^{-5}$	90%	DESIG=45
Γ_{20}	$\Upsilon(2S)\pi^+\pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$		DESIG=18
Γ_{21}	$\Upsilon(2S)\eta$	$(4.1 \pm 0.6) \times 10^{-3}$		DESIG=46
Γ_{22}	$\Upsilon(3S)\pi^+\pi^-$	$(4.8^{+1.9}_{-1.7}) \times 10^{-3}$		DESIG=19
Γ_{23}	$\Upsilon(1S)K^+K^-$	$(6.1 \pm 1.8) \times 10^{-4}$		DESIG=20
Γ_{24}	$\eta \Upsilon_J(1D)$	$(4.8 \pm 1.1) \times 10^{-3}$		DESIG=40
Γ_{25}	$h_b(1P)\pi^+\pi^-$	$(3.5^{+1.0}_{-1.3}) \times 10^{-3}$		DESIG=26
Γ_{26}	$h_b(2P)\pi^+\pi^-$	$(5.7^{+1.7}_{-2.1}) \times 10^{-3}$		DESIG=27
Γ_{27}	$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(2.5 \pm 2.3) \times 10^{-3}$		DESIG=41
Γ_{28}	$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	$< 6.3 \times 10^{-3}$	90%	DESIG=30
Γ_{29}	$\chi_{b0}(1P)\omega$	$< 3.9 \times 10^{-3}$	90%	DESIG=31
Γ_{30}	$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$< 4.8 \times 10^{-3}$	90%	DESIG=32
Γ_{31}	$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$		DESIG=33
Γ_{32}	$\chi_{b1}(1P)\omega$	$(1.57 \pm 0.30) \times 10^{-3}$		DESIG=34
Γ_{33}	$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$		DESIG=35
Γ_{34}	$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$		DESIG=36
Γ_{35}	$\chi_{b2}(1P)\omega$	$(6.0 \pm 2.7) \times 10^{-4}$		DESIG=37
Γ_{36}	$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(6 \pm 4) \times 10^{-4}$		DESIG=38
Γ_{37}	$\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega$	$< 3.8 \times 10^{-5}$	90%	DESIG=39
Γ_{38}	$\eta_b(1S)\omega$	$< 1.3 \times 10^{-3}$	90%	DESIG=42
Γ_{39}	$\eta_b(2S)\omega$	$< 5.6 \times 10^{-3}$	90%	DESIG=43

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{40}	ϕ anything	$(13.8^{+2.4}_{-1.7})\%$		DESIG=12
Γ_{41}	D^0 anything + c.c.	$(112 \pm 6)\%$		DESIG=13
Γ_{42}	D_s anything + c.c.	$(44.7 \pm 2.6)\%$		DESIG=6
Γ_{43}	J/ψ anything	$(2.06 \pm 0.21)\%$		DESIG=14
Γ_{44}	B^0 anything + c.c.	$(77 \pm 8)\%$		DESIG=21
Γ_{45}	B^+ anything + c.c.	$(72 \pm 6)\%$		DESIG=22

$\Upsilon(10860)$ PARTIAL WIDTHS

NODE=M092220

$\Gamma(e^+e^-)$				Γ_{15}
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
0.31 $\pm$ 0.07 OUR AVERAGE	Error includes scale factor of 1.3.			
0.22 $\pm$ 0.05 $\pm$ 0.07	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons	
0.365 $\pm$ 0.070	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons	

NODE=M092W1
NODE=M092W1

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_{15}\Gamma_{17}/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

NODE=M092R50
NODE=M092R50

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.09 $\pm$ 0.34	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6$ –11.05 GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092R50;LINKAGE=A

² Reported as the range 0.75–1.43 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R50;LINKAGE=B

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_{15}\Gamma_{20}/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

NODE=M092R51
NODE=M092R51

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.58 $\pm$ 1.22	1,2 MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6$ –11.05 GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M092R51;LINKAGE=A

² Reported as the range 1.35–3.80 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R51;LINKAGE=B

$$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{22}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.73±0.30	1,2 MIZUK	19	BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

² Reported as the range 0.43–1.03 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M092R52
NODE=M092R52

NODE=M092R52;LINKAGE=A

NODE=M092R52;LINKAGE=B

$\Upsilon(10860)$ BRANCHING RATIOS

“OUR EVALUATION” is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at <https://hflav.web.cern.ch/>.

NODE=M092230

NODE=M092230

$$\Gamma(B\bar{B}X)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.762^{+0.027}_{-0.043} OUR EVALUATION (Produced by HFLAV)

0.71 ± 0.06 OUR AVERAGE

0.737±0.032±0.051	1063	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.589±0.100±0.092		² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \rightarrow B^{\pm,0}$ anything.

² Using measurements or limits from AQUINES 06.

NODE=M092R13
NODE=M092R13

→ UNCHECKED ←

NODE=M092R13;LINKAGE=DR
NODE=M092R13;LINKAGE=HU

$$\Gamma(B\bar{B})/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE (units 10 ⁻²)	CL%	DOCUMENT ID	TECN	COMMENT

5.5^{+1.0}_{-0.9} ± 0.4 ¹ DRUTSKOY 10 BELL $\Upsilon(5S) \rightarrow B^+X, B^0X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<13.8 90 ² HUANG 07 CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

NODE=M092R16
NODE=M092R16

NODE=M092R16;LINKAGE=DR
NODE=M092R16;LINKAGE=HU

$$\Gamma(B\bar{B})/\Gamma(B\bar{B}X) \quad \Gamma_2/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.22 90 AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R05
NODE=M092R05

$$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.137±0.016 OUR AVERAGE

0.137±0.013±0.011	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.143±0.053±0.027	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

NODE=M092R15
NODE=M092R15

NODE=M092R15;LINKAGE=DR
NODE=M092R15;LINKAGE=HU

$$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X) \quad \Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.24±0.09±0.03 10 AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R06
NODE=M092R06

$$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

0.381±0.034 OUR AVERAGE

0.375 ^{+0.021} _{-0.019} ± 0.030	¹ DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X, B^0X$
0.436±0.083±0.072	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

NODE=M092R14
NODE=M092R14

NODE=M092R14;LINKAGE=DR
NODE=M092R14;LINKAGE=HU

$$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X) \quad \Gamma_4/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.74±0.15±0.08 31 AQUINES 06 CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

NODE=M092R07
NODE=M092R07

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.197 90 ¹ HUANG 07 CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Using measurements or limits from AQUINES 06.

NODE=M092R17
NODE=M092R17

NODE=M092R17;LINKAGE=HU

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.32	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

$$\Gamma_5/\Gamma_1$$

NODE=M092R08
NODE=M092R08

$$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.0 \pm 1.2 \pm 0.3$	0	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+0}\pi^- X$

$$\Gamma_6/\Gamma$$

NODE=M092R28
NODE=M092R28

¹ Assuming isospin conservation.

NODE=M092R28;LINKAGE=DR

$$[\Gamma(B^*\bar{B}\pi) + \Gamma(B\bar{B}^*\pi)]/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.3^{+2.3}_{-2.1} \pm 0.8$	38	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+0}\pi^- X$

$$\Gamma_7/\Gamma$$

NODE=M092R29
NODE=M092R29

¹ Assuming isospin conservation.

NODE=M092R29;LINKAGE=DR

$$\Gamma(B^*\bar{B}^*\pi)/\Gamma_{\text{total}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.0^{+1.4}_{-1.3} \pm 0.4$	5	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^{+0}\pi^- X$

$$\Gamma_8/\Gamma$$

NODE=M092R30
NODE=M092R30

¹ Assuming isospin conservation.

NODE=M092R30;LINKAGE=DR

$$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.089	90	¹ HUANG	07	CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

$$\Gamma_9/\Gamma$$

NODE=M092R18
NODE=M092R18

¹ Using measurements or limits from AQUINES 06.

NODE=M092R18;LINKAGE=HU

$$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$

$$\Gamma_9/\Gamma_1$$

NODE=M092R09
NODE=M092R09

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT

$$\Gamma_{10}/\Gamma = (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})/\Gamma$$

NODE=M092R01
NODE=M092R01

$$0.201^{+0.030}_{-0.031} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$0.189^{+0.027}_{-0.021} \text{ OUR AVERAGE}$$

0.172 ± 0.030	¹ ESEN	13	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
$0.21^{+0.06}_{-0.03}$	² HUANG	07	CLEO	$\Upsilon(5S) \rightarrow D_s X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.180 \pm 0.013 \pm 0.032$	³ DRUTSKOY	07	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
$0.160 \pm 0.026 \pm 0.058$	⁴ ARTUSO	05B	CLEO	$e^+e^- \rightarrow D_s X$

¹ Supersedes DRUTSKOY 07.

² Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using $B(D_s^+ \rightarrow \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.

³ Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

⁴ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

NODE=M092R01;LINKAGE=ES
NODE=M092R01;LINKAGE=HU

NODE=M092R01;LINKAGE=DR
NODE=M092R01;LINKAGE=AR

$$\Gamma(B_s^{(*)}\bar{B}_s^{(*)})/\Gamma(B\bar{B}X)$$

VALUE	DOCUMENT ID

$$\Gamma_{10}/\Gamma_1$$

NODE=M092R34
NODE=M092R34

$$0.264^{+0.052}_{-0.045} \text{ OUR EVALUATION}$$

→ UNCHECKED ←

$$\Gamma(B_s^*\bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
87.8 ± 1.5 OUR AVERAGE				

NODE=M092R19
NODE=M092R19

87.0 ± 1.7	^{1,2} ESEN	13	BELL	$B_s^0 \rightarrow D_s^- \pi^+$
$90.5 \pm 3.2 \pm 0.1$	^{2,3} LI	12	BELL	$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$90.1^{+3.8}_{-4.0} \pm 0.2$	⁴ LOUVOT	09	BELL	$10.86 e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
$93^{+7}_{-9} \pm 1$	⁴ DRUTSKOY	07A	BELL	Superseded by LOUVOT 09

¹Supersedes LOUVOT 09.

²With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³The ratios $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ and $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

⁴From a measurement of $\sigma(e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}) / \sigma(e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.

$$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2})

DOCUMENT ID

TECN

COMMENT

$2.6^{+2.6}_{-2.5}$

LOUVOT 09 BELL 10.86 $e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

NODE=M092R19;LINKAGE=ES

NODE=M092R19;LINKAGE=IL

NODE=M092R19;LINKAGE=LI

NODE=M092R19;LINKAGE=DR

NODE=M092R24
NODE=M092R24

$$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{11}/\Gamma_{13}$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.16

90

BONVICINI

06

CLE3

e^+e^-

NODE=M092R03
NODE=M092R03

$$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

6.7 ± 1.2 OUR AVERAGE

7.3 ± 1.4

^{1,2} ESEN

13

BELL

$B_s^0 \rightarrow D_s^- \pi^+$

$4.9 \pm 2.5 \pm 0.0$

227

^{2,3} LI

12

BELL

$B_s^0 \rightarrow J/\psi \eta^{(\prime)}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.3^{+3.3}_{-3.0} \pm 0.1$

LOUVOT

09

BELL

10.86 $e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$

¹Supersedes LOUVOT 09.

²With $N(B_s^{(*)}\bar{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.

³The ratios $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ and $N(B_s^{(*)}\bar{B}_s^{(*)}) / N(B_s^{(*)}\bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

NODE=M092R25;LINKAGE=ES

NODE=M092R25;LINKAGE=IL

NODE=M092R25;LINKAGE=LI

$$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$$

$$\Gamma_{12}/\Gamma_{13}$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

<0.16

90

BONVICINI

06

CLE3

e^+e^-

NODE=M092R04
NODE=M092R04

$$\Gamma(\text{no open-bottom})/\Gamma_{\text{total}}$$

$$\Gamma_{14}/\Gamma$$

VALUE

DOCUMENT ID

$0.038^{+0.051}_{-0.005}$ OUR EVALUATION

NODE=M092R33
NODE=M092R33

→ UNCHECKED ←

$$\Gamma(K^*(892)^0\bar{K}^0)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

$<1.0 \times 10^{-5}$

90

SHEN

13A

BELL

$e^+e^- \rightarrow K^*(892)^0\bar{K}^0$

NODE=M092R35
NODE=M092R35

$$\Gamma(\eta\tau_J(1D))/\Gamma_{\text{total}}$$

$$\Gamma_{24}/\Gamma$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

$4.82 \pm 0.92 \pm 0.67$

¹ TAMPONI

18

BELL

$e^+e^- \rightarrow \tau(5S) \rightarrow \eta X$

NODE=M092R48
NODE=M092R48

¹Mainly $J = 2$, assumes no continuum contribution under $\tau(5S)$.

NODE=M092R48;LINKAGE=A

$$\Gamma(\tau(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma$$

VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

$5.3 \pm 0.3 \pm 0.5$

325

¹ CHEN

08

BELL

10.87 $e^+e^- \rightarrow \tau(1S)\pi^+\pi^-$

NODE=M092R20
NODE=M092R20

¹Assuming that the observed events are solely due to the $\tau(5S)$ resonance.

NODE=M092R20;LINKAGE=CH

$$\Gamma(\tau(1S)\eta)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

$0.85 \pm 0.15 \pm 0.08$

^{1,2} KOVALENKO

21

BELL

$e^+e^- \rightarrow \tau(5S)$

NODE=M092R55
NODE=M092R55

¹Assuming that the observed events are solely due to the $\tau(5S)$ resonance.

²Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

NODE=M092R55;LINKAGE=A
NODE=M092R55;LINKAGE=B

$$\Gamma(\tau(1S)\eta')/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma$$

VALUE

CL%

DOCUMENT ID

TECN

COMMENT

$<6.9 \times 10^{-5}$

90

^{1,2} KOVALENKO

21

BELL

$e^+e^- \rightarrow \tau(5S)$

NODE=M092R56
NODE=M092R56

¹Assuming that the observed events are solely due to the $\tau(5S)$ resonance.

²Using a data sample of 118.3 fb^{-1} of e^+e^- collisions at $\sqrt{s} = 10.866$ GeV.

NODE=M092R56;LINKAGE=A
NODE=M092R56;LINKAGE=B

$$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	¹ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R21
NODE=M092R21

NODE=M092R21;LINKAGE=CH

$$\Gamma(\Upsilon(2S)\eta)/\Gamma_{\text{total}} \quad \Gamma_{21}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$4.13 \pm 0.41 \pm 0.37$	^{1,2} KOVALENKO 21	BELL	$e^+ e^- \rightarrow \Upsilon(5S)$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

² Using a data sample of 118.3 fb^{-1} of $e^+ e^-$ collisions at $\sqrt{s} = 10.866 \text{ GeV}$.

NODE=M092R57
NODE=M092R57

NODE=M092R57;LINKAGE=A
NODE=M092R57;LINKAGE=B

$$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{22}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8 \pm 1.8 \pm 1.5 \pm 0.7$	10	¹ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R22
NODE=M092R22

NODE=M092R22;LINKAGE=CH

$$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1 \pm 1.6 \pm 1.4 \pm 1.0$	20	¹ CHEN 08	BELL	$10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

NODE=M092R23
NODE=M092R23

NODE=M092R23;LINKAGE=CH

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-) \quad \Gamma_{25}/\Gamma_{20}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.45 \pm 0.08 \pm 0.07 \pm 0.12$	ADACHI 12	BELL	$10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R31
NODE=M092R31

$$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-) \quad \Gamma_{26}/\Gamma_{20}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.77 \pm 0.08 \pm 0.22 \pm 0.17$	ADACHI 12	BELL	$10.86 e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R32
NODE=M092R32

$$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-) \quad \Gamma_{25}/\Gamma_{26}$$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.616 \pm 0.052 \pm 0.017$	MIZUK 16	BELL	$e^+ e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$

NODE=M092R00
NODE=M092R00

$$\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{27}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.6 \pm 2.2$	YIN 18	BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M092R49
NODE=M092R49

$$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{28}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.3 \times 10^{-3}$	90	¹ HE 14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R36
NODE=M092R36

NODE=M092R36;LINKAGE=A

$$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}} \quad \Gamma_{29}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.9 \times 10^{-3}$	90	¹ HE 14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R37
NODE=M092R37

NODE=M092R37;LINKAGE=A

$$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}} \quad \Gamma_{30}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.8 \times 10^{-3}$	90	¹ HE 14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R38
NODE=M092R38

NODE=M092R38;LINKAGE=A

$$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{31}/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.85 \pm 0.23 \pm 0.23$	80	¹ HE 14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+ e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016 \text{ nb}$ from ESEN 13. Correlated with other results from HE 14.

NODE=M092R39
NODE=M092R39

NODE=M092R39;LINKAGE=A

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.57 \pm 0.22 \pm 0.21$	60	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R40
NODE=M092R40

NODE=M092R40;LINKAGE=A

 $\Gamma(\chi_{b1}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.15 \pm 0.11$	24	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R41
NODE=M092R41

NODE=M092R41;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.17 \pm 0.27 \pm 0.14$	29	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R42
NODE=M092R42

NODE=M092R42;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.60 \pm 0.23 \pm 0.15$	13	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R43
NODE=M092R43

NODE=M092R43;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.38 \pm 0.16 \pm 0.09$	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Accounting for correlated systematics.

NODE=M092R44
NODE=M092R44

NODE=M092R44;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.61 \pm 0.22 \pm 0.28$	16	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.

NODE=M092R45
NODE=M092R45

NODE=M092R45;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})/\Gamma(\chi_{b1}(1P)(\pi^+ \pi^- \pi^0)_{\text{non-}\omega})$

VALUE	DOCUMENT ID	TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

$1.20 \pm 0.55 \pm 0.65$	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Accounting for correlated systematics.

NODE=M092R46
NODE=M092R46

NODE=M092R46;LINKAGE=A

 $\Gamma(\eta_b(1S)\omega)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.3 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$

¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

NODE=M092R53
NODE=M092R53

NODE=M092R53;LINKAGE=A

 $\Gamma(\eta_b(2S)\omega)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.6 \times 10^{-3}$	90	¹ OSKIN	20	BELL $e^+e^- \rightarrow \omega X$

¹ Using $\sigma_{b\bar{b}} = 0.340 \pm 0.016$ nb from TAMPONI 15.

NODE=M092R54
NODE=M092R54

NODE=M092R54;LINKAGE=A

 $\Gamma(\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.8 \times 10^{-5}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+ \pi^- \pi^0 \gamma \Upsilon(1S)$

¹ Assuming that all the $b\bar{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between $10.55 \text{ GeV}/c^2$ and $10.65 \text{ GeV}/c^2$, the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5} .

NODE=M092R47
NODE=M092R47

NODE=M092R47;LINKAGE=A

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{40}/Γ
$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$	

NODE=M092R12
 NODE=M092R12

 $\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{41}/Γ
1.12 ± 0.06 OUR AVERAGE	[1.08 ± 0.08 OUR 2023 AVERAGE]			

NODE=M092R10
 NODE=M092R10
 NEW

1.117 $\pm 0.005 \pm 0.060$ ¹ ZHUKOVA 23 BELL $\Upsilon(5S) \rightarrow D^0 X, \bar{D}^0 X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.076 $\pm 0.040 \pm 0.068$ DRUTSKOY 07 BELL $\Upsilon(5S) \rightarrow D^0 X, \bar{D}^0 X$

¹ Supersedes DRUTSKOY 07.

NODE=M092R10;LINKAGE=A

 $\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{42}/Γ
0.447 ± 0.026 OUR AVERAGE	[0.46 ± 0.06 OUR 2023 AVERAGE]			

NODE=M092R02
 NODE=M092R02
 NEW

0.447 $\pm 0.003 \pm 0.027$ ¹ ZHUKOVA 23 BELL $\Upsilon(5S) \rightarrow D_s^\pm X$

0.44 $\pm 0.09 \pm 0.04$ ² ARTUSO 05B CLE3 $\Upsilon(5S) \rightarrow D_s^\pm X$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.472 $\pm 0.024 \pm 0.072$ ³ DRUTSKOY 07 BELL $\Upsilon(5S) \rightarrow D_s^\pm X$

¹ Supersedes DRUTSKOY 07.

² ARTUSO 05B reports $[\Gamma(\Upsilon(10860) \rightarrow D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$ which we divide by our best value $B(D_s^+ \rightarrow \phi \pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

NODE=M092R02;LINKAGE=A
 NODE=M092R02;LINKAGE=AR

NODE=M092R02;LINKAGE=DR

 $\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	Γ_{43}/Γ
2.060 $\pm 0.160 \pm 0.134$	DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow J/\psi X$	

NODE=M092R11
 NODE=M092R11

 $\Gamma(B^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{44}/Γ
0.770 $^{+0.058}_{-0.056} \pm 0.061$	352	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^0 X$	

NODE=M092R26
 NODE=M092R26

 $\Gamma(B^+ \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{45}/Γ
0.721 $^{+0.039}_{-0.038} \pm 0.050$	711	DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+ X$	

NODE=M092R27
 NODE=M092R27

 $\Upsilon(10860)$ REFERENCES

NODE=M092

ZHUKOVA	23	JHEP 2308 131	V. Zhukova <i>et al.</i>	(BELLE Collab.)
KOVALENKO	21	PR D104 112006	E. Kovalenko <i>et al.</i>	(BELLE Collab.)
DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>	
OSKIN	20	PR D102 092011	P. Oskin <i>et al.</i>	(BELLE Collab.)
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)
TAMPONI	18	EPJ C78 633	U. Tamponi <i>et al.</i>	(BELLE Collab.)
YIN	18	PR D98 091102	J.H. Yin <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
TAMPONI	15	PRL 115 142001	U. Tamponi <i>et al.</i>	(BELLE Collab.)
HE	14	PRL 113 142001	X.H. He <i>et al.</i>	(BELLE Collab.)
ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)
SHEN	13A	PR D88 052019	C.P. Shen <i>et al.</i>	(BELLE Collab.)
ADACHI	12	PRL 108 032001	I. Adachi <i>et al.</i>	(BELLE Collab.)
LI	12	PRL 108 181808	J. Li <i>et al.</i>	(BELLE Collab.)
CHEN	10	PR D82 091106	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	10	PR D81 112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)
CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

REFID=62312
 REFID=61452
 REFID=60595
 REFID=60735
 REFID=60090
 REFID=59195
 REFID=59468
 REFID=57465
 REFID=57121
 REFID=56996
 REFID=55927
 REFID=54894
 REFID=55591
 REFID=53962
 REFID=54116
 REFID=53531
 REFID=53358
 REFID=52661
 REFID=52646
 REFID=52153
 REFID=51621
 REFID=51852
 REFID=51624
 REFID=51106
 REFID=50995
 REFID=51004
 REFID=50992
 REFID=22368
 REFID=22369

$\Upsilon(11020)$

$$J^{PC} = 0^{-}(1^{-}-)$$

NODE=M093

 $\Upsilon(11020)$ MASS

NODE=M093M

NODE=M093M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11000 $\pm$ 4 OUR AVERAGE			
11000.0 $^{+4.0+1.0}_{-4.5-1.3}$	¹ MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10999.0 $^{+7.3+16.9}_{-7.8-1.0}$	² MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
11001 $\pm$ 1	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$
11003.0 $\pm 1.1^{+0.9}_{-1.0}$	^{4,5} SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
10987.5 $^{+6.4+9.1}_{-2.5-2.3}$	^{6,7} SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
10996 $\pm$ 2	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
11019 $\pm 5 \pm 7$	BESSION	85 CLEO	$e^+e^- \rightarrow$ hadrons
11020 $\pm$ 30	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M093M;LINKAGE=E

² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

NODE=M093M;LINKAGE=D

³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.

NODE=M093M;LINKAGE=G

⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

NODE=M093M;LINKAGE=A

⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

NODE=M093M;LINKAGE=B

⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

NODE=M093M;LINKAGE=C

⁷ Superseded by MIZUK 19.

NODE=M093M;LINKAGE=F

⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093M;LINKAGE=AU

 $\Upsilon(11020)$ WIDTH

NODE=M093W

NODE=M093W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
24 $^{+8}_{-6}$ OUR AVERAGE			
23.8 $^{+8.0+0.7}_{-6.8-1.8}$	¹ MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
27 $^{+27+5}_{-11-12}$	² MIZUK	16 BELL	$e^+e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
35.1 ± 1.2	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$
39.3 $^{+1.7+1.3}_{-1.6-2.4}$	^{4,5} SANTEL	16 BELL	$e^+e^- \rightarrow$ hadrons
61 $^{+9+2}_{-19-20}$	^{6,7} SANTEL	16 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
37 ± 3	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow$ hadrons
61 $\pm 13 \pm 22$	BESSION	85 CLEO	$e^+e^- \rightarrow$ hadrons
90 ± 20	LOVELOCK	85 CUSB	$e^+e^- \rightarrow$ hadrons

OCCUR=2

- ¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.
- ² From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1, 2$ cross sections at 22 energy points within $\sqrt{s} = 10.77\text{--}11.02$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.
- ³ From a fit to the dressed cross sections of AUBERT 09E by BaBar and SANTEL 16 by Belle above 10.68 GeV with a coherent sum of a continuum amplitude and three Breit-Wigner functions with constant widths.
- ⁴ From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s} = 10.82\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).
- ⁵ Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.
- ⁶ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n=1, 2, 3$, cross sections at 25 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.
- ⁷ Superseded by MIZUK 19.
- ⁸ In a model where a flat non-resonant $b\bar{b}$ -continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

NODE=M093W;LINKAGE=E

NODE=M093W;LINKAGE=D

NODE=M093W;LINKAGE=G

NODE=M093W;LINKAGE=A

NODE=M093W;LINKAGE=B

NODE=M093W;LINKAGE=C

NODE=M093W;LINKAGE=F

NODE=M093W;LINKAGE=AU

 $\Upsilon(11020)$ DECAY MODES

NODE=M093215;NODE=M093

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	$(5.4^{+1.9}_{-2.1}) \times 10^{-6}$
Γ_2 $\Upsilon(1S)\pi^+\pi^-$	
Γ_3 $\Upsilon(2S)\pi^+\pi^-$	
Γ_4 $\Upsilon(3S)\pi^+\pi^-$	
Γ_5 $\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(9^{+9}_{-8}) \times 10^{-3}$
Γ_6 $\chi_{b1}(1P)\pi^+\pi^-\pi^0$	seen
Γ_7 $\chi_{b2}(1P)\pi^+\pi^-\pi^0$	seen

DESIG=1

DESIG=5

DESIG=6

DESIG=7

DESIG=2

DESIG=3

DESIG=4

 $\Upsilon(11020)$ PARTIAL WIDTHS

NODE=M093220

$\Gamma(e^+e^-)$				Γ_1
VALUE (keV)	DOCUMENT ID	TECN	COMMENT	
0.130$\pm$0.030 OUR AVERAGE				
0.095 $\pm$ 0.03 $\pm$ 0.035	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons	
0.156 $\pm$ 0.040	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons	

NODE=M093W1
NODE=M093W1

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_2/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

NODE=M093R04
NODE=M093R04

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.46 $\pm$ 0.08 ^{1,2} MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M093R04;LINKAGE=A

² Reported as the range 0.38–0.54 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M093R04;LINKAGE=B

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_3/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

NODE=M093R05
NODE=M093R05

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.65 $\pm$ 0.52 ^{1,2} MIZUK 19 BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

NODE=M093R05;LINKAGE=A

² Reported as the range 0.13–1.16 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.

NODE=M093R05;LINKAGE=B

$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID
TECN	COMMENT

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.33±0.16	1,2 MIZUK	19	BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
¹ From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1, 2, 3$, cross sections at 28 energy points within $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.				
² Reported as the range 0.17–0.49 eV obtained from multiple solutions of an amplitude fit within a model composed as a sum of Breit-Wigner functions.				

NODE=M093R06
NODE=M093R06

NODE=M093R06;LINKAGE=A
NODE=M093R06;LINKAGE=B

$\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE (units 10 ⁻³)	DOCUMENT ID
TECN	COMMENT

8.7±4.3 ^{+7.6} _{-6.6}	YIN	18	BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M093R00
NODE=M093R00

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	DOCUMENT ID
TECN	COMMENT

seen	YIN	18	BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M093R01
NODE=M093R01

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$	Γ_7/Γ
VALUE	DOCUMENT ID
TECN	COMMENT

seen	YIN	18	BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M093R02
NODE=M093R02

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)$	Γ_7/Γ_6
VALUE	DOCUMENT ID
TECN	COMMENT

0.4±0.2	YIN	18	BELL	$e^+e^- \rightarrow \text{hadrons}$

NODE=M093R03
NODE=M093R03

Υ(11020) REFERENCES

DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>	
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)
YIN	18	PR D98 091102	J.H. Yin <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)
BESSION	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)

NODE=M093

REFID=60595
REFID=60090
REFID=59468
REFID=57465
REFID=57121
REFID=52661
REFID=22368
REFID=22369

OTHER MESONS

NODE=MXXX050

$T_{cs0}^*(2870)^0$

$I(J^P) = ?(0^+)$

NODE=M250

OMITTED FROM SUMMARY TABLE
was $X_0(2900)$

An exotic state with minimal quark content $\bar{c}d\bar{s}u$. Observed by AAIJ 20AI using full amplitude analysis of $B^+ \rightarrow D^+ D^- K^+$ decays.

NODE=M250

$T_{cs0}^*(2870)^0$ MASS

NODE=M250M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2866±7±2	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$

NODE=M250M

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M250M;LINKAGE=A

$T_{cs0}^*(2870)^0$ WIDTH

NODE=M250W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
57±12±4	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$

NODE=M250W

¹ Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M250W;LINKAGE=A

$T_{cs0}^*(2870)^0$ DECAY MODES

NODE=M250215;NODE=M250

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^- K^+$	seen

DESIG=1

$T_{cs0}^*(2870)^0$ BRANCHING RATIOS

NODE=M250225

$\Gamma(D^- K^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$	

NODE=M250R01
NODE=M250R01

$T_{cs0}^*(2870)^0$ REFERENCES

NODE=M250

AAIJ	20AF PRL 125 242001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AI PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=60702
REFID=60739

NODE=M251

$T_{cs1}^*(2900)^0$

$I(J^P) = ?(1^-)$

OMITTED FROM SUMMARY TABLE
was $X_1(2900)$

An exotic state with minimal quark content $\bar{c}d\bar{s}u$. Observed by
AAIJ 20AI using full amplitude analysis of $B^+ \rightarrow D^+ D^- K^+$ de-
cays.

NODE=M251

$T_{cs1}^*(2900)^0$ MASS

NODE=M251M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$2904 \pm 5 \pm 1$	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$

NODE=M251M

¹Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-
Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M251M;LINKAGE=B

$T_{cs1}^*(2900)^0$ WIDTH

NODE=M251W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
$110 \pm 11 \pm 4$	1.2k	¹ AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$

NODE=M251W

¹Obtained from the full amplitude analysis. Parameterized with the relativistic Breit-
Wigner line shape. Also confirmed by the model-independent analysis of AAIJ 20AF.

NODE=M251W;LINKAGE=A

$T_{cs1}^*(2900)^0$ DECAY MODES

NODE=M251215;NODE=M251

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^- K^+$	seen

DESIG=1

$T_{cs1}^*(2900)^0$ BRANCHING RATIOS

NODE=M251225

$\Gamma(D^- K^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AAIJ	20AI LHCb	$B^+ \rightarrow D^+ D^- K^+$	

NODE=M251R01
NODE=M251R01

$T_{cs1}^*(2900)^0$ REFERENCES

NODE=M251

AAIJ	20AF PRL 125 242001	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	20AI PR D102 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=60702
REFID=60739

NODE=M269

$T_{c\bar{s}0}^*(2900)$

$$I(J^P) = 1(0^+)$$

OMITTED FROM SUMMARY TABLE

Observed by LHCb in AAIJ 23B using a simultaneous amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^+ \rightarrow D^- D_s^+ \pi^+$. The $T_{c\bar{s}0}^*(2900)^0 \rightarrow D_s^+ \pi^-$ and $T_{c\bar{s}0}^*(2900)^{++} \rightarrow D_s^+ \pi^+$ decays are observed with 8.0 and 6.5 σ significance, respectively.

NODE=M269

$T_{c\bar{s}0}^*(2900)^0$ MASS

NODE=M269M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2892 ± 14 ± 15	¹ AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$

NODE=M269M

¹From an amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a mass of $2908 \pm 11 \pm 20$ MeV.

NODE=M269M;LINKAGE=A

$T_{c\bar{s}0}^*(2900)^{++}$ MASS

NODE=M269M++

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2921 ± 17 ± 20	² AAIJ	23C	LHCB $B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269M++

²From an amplitude analysis of $B^- \rightarrow D^- D_s^+ \pi^+$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a mass of $2908 \pm 11 \pm 20$ MeV.

NODE=M269M++;LINKAGE=A

$T_{c\bar{s}0}^*(2900)^0$ WIDTH

NODE=M269W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
119 ± 26 ± 13	³ AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$

NODE=M269W

³From an amplitude analysis of $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a width of $136 \pm 23 \pm 13$ MeV.

NODE=M269W;LINKAGE=A

$T_{c\bar{s}0}^*(2900)^{++}$ WIDTH

NODE=M269W++

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
137 ± 32 ± 17	⁴ AAIJ	23C	LHCB $B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269W++

⁴From an amplitude analysis of $B^- \rightarrow D^- D_s^+ \pi^+$. A simultaneous fit to $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$ and $B^- \rightarrow D^- D_s^+ \pi^+$ assuming isospin symmetry yields a width of $136 \pm 23 \pm 13$ MeV.

NODE=M269W++;LINKAGE=A

$T_{c\bar{s}0}^*(2900)$ DECAY MODES

NODE=M269215;NODE=M269

Mode	Fraction (Γ_i/Γ)
Γ_1 $D_s^+ \pi^-$	seen
Γ_2 $D_s^+ \pi^+$	seen

DESIG=1

DESIG=2

$T_{c\bar{s}0}^*(2900)$ BRANCHING RATIOS

NODE=M269225

$\Gamma(D_s^+ \pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	23C	LHCB $B^0 \rightarrow \bar{D}^0 D_s^+ \pi^-$

NODE=M269R01
NODE=M269R01

$\Gamma(D_s^+ \pi^+)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AAIJ	23C	LHCB	$B^- \rightarrow D^- D_s^+ \pi^+$

NODE=M269R02
NODE=M269R02

$T_{c\bar{s}0}^*(2900)$ REFERENCES

NODE=M269

AAIJ	23B	PR D108 012017	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	23C	PRL 131 041902	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=62091
REFID=62094

NODE=M265

$T_{cc}(3875)^+$

$I(J^P) = ?(?^?)$

OMITTED FROM SUMMARY TABLE

Observed with large significance by AAIJ 22E in the doubly-charmed (C = 2) decay mode $D^0 D^0 \pi^+$ using inclusive pp collisions at 7, 8, and 13 TeV.

NODE=M265

$T_{cc}(3875)^+$ MASS

OUR FIT value comes from the measuremet of $m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0})$ below and $m_{D^{*+}} + m_{D^0}$ values.

NODE=M265M

NODE=M265M

NODE=M265M

VALUE (MeV)	DOCUMENT ID
3874.83±0.11 OUR FIT	

$m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0})$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
=0.27 ±0.06 OUR FIT				
=0.273±0.061 ^{+0.012} _{-0.015}	117	¹ AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$

NODE=M265DM
NODE=M265DM

¹ The fit assumes a relativistic P -wave Breit Wigner function modified by Blatt-Weisskopf form factor with radius 3.5 GeV⁻¹. The significance for $m_{T_{cc}^+} - (m_{D^{*+}} + m_{D^0}) < 0$ is 4.3 σ .

NODE=M265DM;LINKAGE=A

$T_{cc}(3875)^+$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.410±0.165 ^{+0.047} _{-0.057}	117	¹ AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$

NODE=M265W

NODE=M265W

¹ The fit assumes a relativistic P -wave Breit Wigner function modified by Blatt-Weisskopf form factor with radius 3.5 GeV⁻¹.

NODE=M265W;LINKAGE=A

$T_{cc}(3875)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 D^0 \pi^+$	seen

NODE=M265215;NODE=M265

DESIG=1

$T_{cc}(3875)^+$ BRANCHING RATIOS

$\Gamma(D^0 D^0 \pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen	117	AAIJ	22E LHCb	$pp \rightarrow D^0 D^0 \pi^+ X$	

NODE=M265225

NODE=M265R01
NODE=M265R01

$T_{cc}(3875)^+$ REFERENCES

AAIJ	22E	NATP 18 751	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M265

REFID=61658

$T_{c\bar{c}1}(3900)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

was $Z_c(3900)$, $X(3900)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Charged $T_{c\bar{c}1}(3900)^\pm$ seen as a peak in the invariant mass distribution of the $J/\psi\pi^\pm$ system by BES III (ABLIKIM 13T) in $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ at c.m. energy of 4.26 GeV and by radiative return from e^+e^- collisions at $\sqrt{s}$ from 9.46 to 10.86 GeV at Belle (LIU 13B). Partial wave analysis of ABLIKIM 17J determines $J^P = 1^+$ with more than 7σ significance. Neutral $T_{c\bar{c}1}(3900)^0$ seen in the $J/\psi\pi^0$ invariant mass distribution in $e^+e^- \rightarrow \pi^0\pi^0 J/\psi$ at c.m. energies of 4.23, 4.26, and 4.36 GeV by BES III (ABLIKIM 15U) and at 4.17 GeV by XIAO 13A. Peaks in $(D\bar{D}^*)^{0,\pm}$ reported by BES III (ABLIKIM 14A, ABLIKIM 15AB) are assumed to be related.

$T_{c\bar{c}1}(3900)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3887.1±2.6 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.			
3893.1±2.2± 3.0		¹ ABLIKIM	20N BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
3902.6 ^{+5.2+ 3.3} _{-5.0- 1.4}		^{2,3} ABAZOV	19 D0	±	1.96 TeV $p\bar{p} \rightarrow J/\psi\pi^+\pi^- X$
3881.2±4.2±52.7	6k	⁴ ABLIKIM	17J BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
3885.7 ^{+4.3} _{-5.7} ± 8.4		^{2,4} ABLIKIM	15AB BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
3881.7±1.6± 1.6	1.2k	^{2,4} ABLIKIM	15AC BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
3883.9±1.5± 4.2	1.2k	^{2,4} ABLIKIM	14A BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
3894.5±6.6± 4.5	159	² LIU	13B BELL	±	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
3886 ±4 ± 2	81	^{2,5} XIAO	13A	±	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
3904 ±9 ± 5	25	^{2,5} XIAO	13A	0	4.17 $e^+e^- \rightarrow \pi^0\pi^0 J/\psi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3895.0±5.2 ^{+ 4.0} _{- 2.7}	502	^{2,6} ABAZOV	18B D0	±	1.96 TeV $p\bar{p} \rightarrow J/\psi\pi^+\pi^- X$
3894.8±2.3± 3.2	356	^{2,7} ABLIKIM	15U BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
3899.0±3.6± 4.9	307	^{2,8} ABLIKIM	13T BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Pole mass obtained from a fit to a relativistic Breit-Wigner.

² Neglecting interference between the $T_{c\bar{c}1}(3900)$ and other processes.

³ Measured in weak decays of b -flavored hadrons (nonprompt).

⁴ Pole mass obtained from a fit to a Flatte-like formula.

⁵ For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

⁶ The signal of the $T_{c\bar{c}1}(3900)$ is correlated with a parent $J/\psi\pi^+\pi^-$ system in the invariant mass range 4.2–4.7 GeV. Superseded by ABAZOV 19.

⁷ Superseded by ABLIKIM 20N.

⁸ Superseded by ABLIKIM 17J.

NODE=M210

NODE=M210

NODE=M210M

NODE=M210M

OCCUR=2

NODE=M210M;LINKAGE=L

NODE=M210M;LINKAGE=A

NODE=M210M;LINKAGE=G

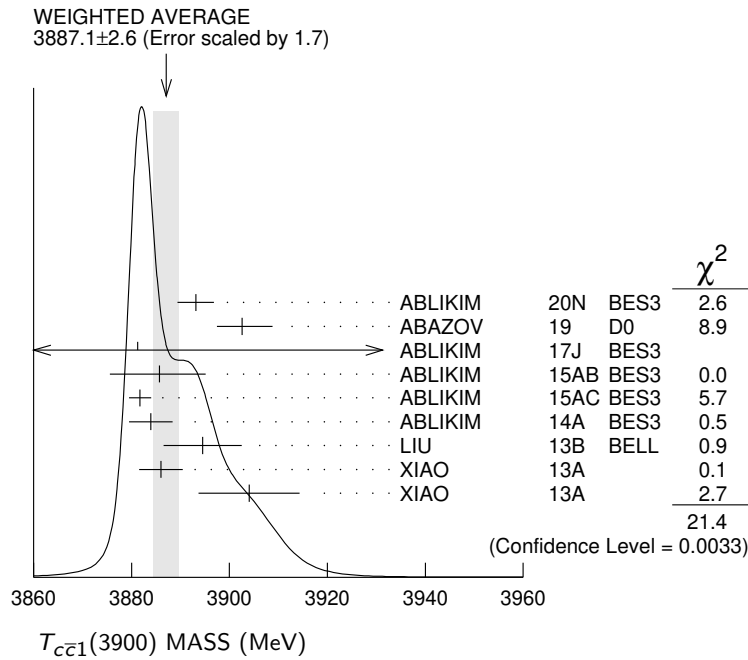
NODE=M210M;LINKAGE=E

NODE=M210M;LINKAGE=B

NODE=M210M;LINKAGE=F

NODE=M210M;LINKAGE=J

NODE=M210M;LINKAGE=K



$T_{c\bar{c}1}(3900)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
28.4± 2.6 OUR AVERAGE						
44.4± 5.2±14.0		¹ ABLIKIM	20N	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
32 +28 +26 -21 -7		^{2,3} ABAZOV	19	D0	±	1.96 TeV $p\bar{p} \rightarrow \pi^+\pi^- J/\psi X$ (non-prompt)
51.8± 4.6±36.0	6 k	⁴ ABLIKIM	17J	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
35 +11 -12 ±15		^{2,4} ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
26.6± 2.0± 2.1	1248	^{2,4} ABLIKIM	15AC	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
24.8± 3.3±11.0	1212	^{2,4} ABLIKIM	14A	BES3	±	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
63 ±24 ±26	159	² LIU	13B	BELL	±	$e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
37 ± 4 ± 8	81	^{2,5} XIAO	13A		±	4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
29.6± 8.2± 8.2	356	^{2,6} ABLIKIM	15U	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
46 ±10 ±20	307	^{2,7} ABLIKIM	13T	BES3	±	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Pole width obtained from a fit to a relativistic Breit-Wigner.

² Neglecting interference between the $T_{c\bar{c}1}(3900)$ and other processes.

³ Measured in weak decays of b -flavored hadrons (nonprompt).

⁴ Pole width obtained from a fit to a Flatte-like formula.

⁵ For $M^2(\pi^+\pi^-) < 0.65 \text{ GeV}^2$. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

⁶ Superseded by ABLIKIM 20N.

⁷ Superseded by ABLIKIM 17J.

NODE=M210W

NODE=M210W

NODE=M210W;LINKAGE=G

NODE=M210W;LINKAGE=A

NODE=M210W;LINKAGE=F

NODE=M210W;LINKAGE=E

NODE=M210W;LINKAGE=B

NODE=M210W;LINKAGE=H

NODE=M210W;LINKAGE=I

$T_{c\bar{c}1}(3900)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\pi$	seen
Γ_2 $h_c\pi^\pm$	not seen
Γ_3 $\eta_c\pi^+\pi^-$	not seen
Γ_4 $\eta_c(1S)\rho(770)^\pm$	seen
Γ_5 $(D\bar{D}^*)^\pm$	seen
Γ_6 $D^0 D^{*-} + \text{c.c.}$	seen
Γ_7 $D^- D^{*0} + \text{c.c.}$	seen
Γ_8 $\omega\pi^\pm$	not seen
Γ_9 $J/\psi\eta$	not seen
Γ_{10} $D^+ D^{*-} + \text{c.c.}$	seen
Γ_{11} $D^0 \bar{D}^{*0} + \text{c.c.}$	seen

NODE=M210215;NODE=M210

DESIG=1

DESIG=2

DESIG=10

DESIG=11;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=8

DESIG=9

DESIG=4

DESIG=5

DESIG=6

DESIG=7

$T_{c\bar{c}1}(3900)$ BRANCHING RATIOS

NODE=M210225

$\Gamma(J/\psi\pi)/\Gamma_{\text{total}}$							Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT		
seen		ABLIKIM	20N	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$	
seen		1 ABAZOV	19	D0	$\pm$	1.96 TeV $p\bar{p} \rightarrow \pi^+\pi^-\pi^0 J/\psi X$ (prompt)	
seen		ABLIKIM	17J	BES3	$\pm$	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 J/\psi$	
seen	356	ABLIKIM	15U	BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$	
not seen		2 ADOLPH	15D	COMP	$\pm$	$\gamma N \rightarrow J/\psi\pi^\pm N$	
seen	307	ABLIKIM	13T	BES3	$\pm$	$e^+e^- \rightarrow \pi^+\pi^-\pi^0 J/\psi$	
seen	25	3 XIAO	13A		0	4.17 $e^+e^- \rightarrow \pi^0\pi^0 J/\psi$	

¹ But not seen in the "prompt" sample (no b-hadron enhancement).² ADOLPH 15D measure $B(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm) \sigma(\gamma N \rightarrow T_{c\bar{c}1}(3900)^\pm N)/\sigma(\gamma N \rightarrow J/\psi N) < 3.7 \times 10^{-3}$ at 90% CL.³ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

NODE=M210R01;LINKAGE=C

NODE=M210R01;LINKAGE=A

NODE=M210R01;LINKAGE=XI

$\Gamma(h_c\pi^\pm)/\Gamma_{\text{total}}$							Γ_2/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
not seen		ABLIKIM	13X	BES3	$\pm$	$e^+e^- \rightarrow h_c\pi^+\pi^-$	

NODE=M210R02

NODE=M210R02

$\Gamma(\eta_c\pi^+\pi^-)/\Gamma_{\text{total}}$							Γ_3/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
not seen		1 VINOKUROVA 15	BELL	0	$B^+ \rightarrow K^+\eta_c\pi^+\pi^-$		

NODE=M210R11

NODE=M210R11

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+Z_c(3900)^0) \times B(X \rightarrow \eta_c\pi^+\pi^-) < 4.7 \times 10^{-5}$ at 90% CL.

NODE=M210R11;LINKAGE=VI

$\Gamma(\eta_c(1S)\rho(770)^\pm)/\Gamma(J/\psi\pi)$							Γ_4/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT		
2.3 $\pm$ 0.8	332	1 ABLIKIM	19BC	BES3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c(1S)$		

¹ Using $e^+e^- \rightarrow \pi^\mp(T_{c\bar{c}1}(3900)^\pm \rightarrow J/\psi\pi^\pm)$ cross section at 4.23 and 4.26 GeV from ABLIKIM 17J.

NODE=M210R12

NODE=M210R12

NODE=M210R12;LINKAGE=A

$\Gamma((D\bar{D}^*)^\pm)/\Gamma(J/\psi\pi)$							Γ_5/Γ_1
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
6.2 $\pm$ 1.1 $\pm$ 2.7		1 ABLIKIM	14A	BES3	$\pm$	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$	

¹ Assuming the same origin of the $(D\bar{D}^*)^\pm$ and $\pi^\pm J/\psi$ decay modes.

NODE=M210R03

NODE=M210R03

NODE=M210R03;LINKAGE=A

$\Gamma(D^0D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$							Γ_6/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
seen		ABLIKIM	15AC	BES3	$\pm$	$e^+e^- \rightarrow \pi^+D^0D^{*-} + \text{c.c.}$	
seen		ABLIKIM	14A	BES3	$\pm$	$e^+e^- \rightarrow \pi^+D^0D^{*-} + \text{c.c.}$	

NODE=M210R09

NODE=M210R09

$\Gamma(D^-D^{*0} + \text{c.c.})/\Gamma_{\text{total}}$							Γ_7/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
seen		ABLIKIM	15AC	BES3	$\pm$	$e^+e^- \rightarrow \pi^+D^-D^{*0} + \text{c.c.}$	
seen		ABLIKIM	14A	BES3	$\pm$	$e^+e^- \rightarrow \pi^+D^-D^{*0} + \text{c.c.}$	

NODE=M210R10

NODE=M210R10

$\Gamma(\omega\pi^\pm)/\Gamma_{\text{total}}$							Γ_8/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
not seen		ABLIKIM	15R	BES3	$\pm$	$e^+e^- \rightarrow \omega\pi^+\pi^-$	

NODE=M210R00

NODE=M210R00

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}}$							Γ_9/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
not seen		ABLIKIM	15Q	BES3	0	4.0–4.6 $e^+e^- \rightarrow J/\psi\eta\pi^0$	

NODE=M210R04

NODE=M210R04

$\Gamma(J/\psi\eta)/\Gamma(J/\psi\pi)$							Γ_9/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT		
<0.15	90	ABLIKIM	15Q	BES3	0	4.226 $e^+e^- \rightarrow J/\psi\eta\pi^0$	

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.65	90	ABLIKIM	15Q	BES3	0	4.257 $e^+e^- \rightarrow J/\psi\eta\pi^0$	

NODE=M210R05

NODE=M210R05

OCCUR=2

$\Gamma(D^+D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$							Γ_{10}/Γ
VALUE		DOCUMENT ID	TECN	CHG	COMMENT		
seen		ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$	

NODE=M210R06

NODE=M210R06

$\Gamma(D^0 \bar{D}^{*0} + c.c.)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	ABLIKIM	15AB BES3	0	$e^+ e^- \rightarrow \pi^0 (D \bar{D}^*)^0$

NODE=M210R07
 NODE=M210R07

 $\Gamma(D^+ D^{*-} + c.c.)/\Gamma(D^0 \bar{D}^{*0} + c.c.)$ Γ_{10}/Γ_{11}

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
0.96 ± 0.18 ± 0.12	ABLIKIM	15AB BES3	0	$e^+ e^- \rightarrow \pi^0 (D \bar{D}^*)^0$

NODE=M210R08
 NODE=M210R08

 $T_{c\bar{c}s1}(3900)$ REFERENCES

NODE=M210

ABLIKIM	20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP
ABAZOV	19	PR D100 012005	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	19BC	PR D100 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABAZOV	18B	PR D98 052010	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	17J	PRL 119 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP
ABLIKIM	15AB	PRL 115 222002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15AC	PR D92 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP
ABLIKIM	15Q	PR D92 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15R	PR D92 032009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15U	PRL 115 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADOLPH	15D	PL B742 330	C. Adolph <i>et al.</i>	(COMPASS Collab.)
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
Also		JHEP 1702 088 (errat.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)
ABLIKIM	14A	PRL 112 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.) JP
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13X	PRL 111 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)
XIAO	13A	PL B727 366	T. Xiao <i>et al.</i>	(NWES)

REFID=60338
 REFID=59903
 REFID=60036
 REFID=59442
 REFID=57950
 REFID=56954
 REFID=56967
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 REFID=55409
 REFID=55635
 REFID=55410
 REFID=55593

 $T_{c\bar{c}s1}(4000)$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

was $Z_{cs}(4000)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M259

Seen by AAIJ 21E in $B^+ \rightarrow T_{c\bar{c}s1}(4000)^+ \phi$ with $T_{c\bar{c}s1}(4000)^+ \rightarrow J/\psi K^+$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 15σ . The $J^P = 1^+$ assignment is favored with high significance. ABLIKIM 21G also reports a $J^P = 1^+ Z_{cs}$ state in this mass region using $e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$ with a significance of 5.3σ . The incompatible values for the widths reported by AAIJ 21E and ABLIKIM 21G could either indicate the existence of two separate states or possibly be explained in a coupled channel model (see ORTEGA 21).

 $T_{c\bar{c}s1}(4000)$ MASS

NODE=M259M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3980-4010 OUR EVALUATION				
3988 ± 5 OUR AVERAGE Error includes scale factor of 2.7.				
3991 $^{+12}_{-10}$ $^{+9}_{-17}$	1	AAIJ	23AQ LHCB	$B^0 \rightarrow J/\psi \phi K_S^0$
3992.2 ± 1.7 ± 1.6	2	ABLIKIM	22AE BES3	$e^+ e^- \rightarrow K_S^0 (D_s^- D^{*+} + D_s^{*-} D^+)$
4003 ± 6 $^{+4}_{-14}$	24k	3 AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
3982.5 $^{+1.8}_{-2.6}$ ± 2.1	4	ABLIKIM	21G BES3	$e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$

¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0σ . The mass difference with respect to the charged partner in AAIJ 21E is $-12^{+11}_{-10} \pm 4$ MeV.

² Pole mass for a mass-, width-dependent Breit-Wigner fit to the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6σ .

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15σ .

NODE=M259M
 → UNCHECKED ←

NODE=M259M;LINKAGE=E

NODE=M259M;LINKAGE=D

NODE=M259M;LINKAGE=A

⁴ Pole mass for a mass-dependent Breit-Wigner fit to the mass spectrum recoiling against K^+ at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3 σ .

NODE=M259M;LINKAGE=B

$T_{cc\bar{s}1}(4000)$ WIDTH

NODE=M259W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

5-150 OUR EVALUATION

14 $\pm$ 4 OUR AVERAGE Error includes scale factor of 1.1. [13 $\pm$ 4 MeV OUR 2023 AVERAGE]

NODE=M259W
→ UNCHECKED ←
NEW

105	$+29$ -25	$+17$ -23		¹ AAIJ	23AQ LHCB	$B^0 \rightarrow J/\psi \phi K_S^0$
	7.7 $-$	4.1 3.8	± 4.3	² ABLIKIM	22AE BES3	$e^+ e^- \rightarrow K_S^0 (D_s^- D^{*+} + D_s^{*-} D^+)$
131	± 15	± 26	24k	³ AAIJ	21E LHCB	$B^+ \rightarrow J/\psi \phi K^+$
	12.8 $-$	5.3 4.4	± 3.0	⁴ ABLIKIM	21G BES3	$e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$

¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0 σ .

² Pole width for a mass-, width-dependent Breit-Wigner fit to the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6 σ .

³ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15 σ .

⁴ Pole width for a mass-dependent Breit-Wigner fit to the mass spectrum recoiling against K^+ at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3 σ .

NODE=M259W;LINKAGE=D
NODE=M259W;LINKAGE=C

NODE=M259W;LINKAGE=A
NODE=M259W;LINKAGE=B

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi K^+$	seen
Γ_2 $J/\psi K_S^0$	seen
Γ_3 $D_s^+ \bar{D}^{*0}$ or $D_s^{*+} \bar{D}^0$	seen
Γ_4 $D_s^+ D^{*-}$ or $D_s^{*+} D^-$	seen

NODE=M259215;DESIG=1
DESIG=4
DESIG=2
DESIG=3

$T_{cc\bar{s}1}(4000)$ DECAY MODES

NODE=M259225

$\Gamma(J/\psi K^+)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

seen 24k ¹ AAIJ 21E LHCB $B^+ \rightarrow J/\psi \phi K^+$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 15 σ .

NODE=M259R01
NODE=M259R01

NODE=M259R01;LINKAGE=A

$\Gamma(J/\psi K_S^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen ¹ AAIJ 23AQ LHCB $B^0 \rightarrow J/\psi \phi K_S^0$

¹ From an amplitude analysis of the decay $B^0 \rightarrow J/\psi \phi K_S^0$ with a significance of 4.0 σ .

NODE=M259R02
NODE=M259R02

NODE=M259R02;LINKAGE=A

$\Gamma(D_s^+ \bar{D}^{*0} \text{ or } D_s^{*+} \bar{D}^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen ¹ ABLIKIM 21G BES3 $e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$

¹ Seen in the spectrum recoiling against K^+ in $e^+ e^- \rightarrow K^+ (D_s^- D^{*0} + D_s^{*-} D^0)$ collisions at center of mass energies between 4.628 and 4.698 GeV, with a significance of 5.3 σ .

NODE=M259R00
NODE=M259R00

NODE=M259R00;LINKAGE=A

$\Gamma(J/\psi K^+)/\Gamma(D_s^+ \bar{D}^{*0} \text{ or } D_s^{*+} \bar{D}^0)$ Γ_1/Γ_3

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.03 90 ABLIKIM 23BI BES3 $e^+ e^- \rightarrow K^+ K^- J/\psi$

NODE=M259R04
NODE=M259R04

$\Gamma(D_s^+ D^{*-} \text{ or } D_s^{*+} D^-)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen ¹ ABLIKIM 22AE BES3 $e^+ e^- \rightarrow K_S^0 (D_s^- D^{*+} + D_s^{*-} D^+)$

¹ Seen in the mass spectrum recoiling against K_S^0 at center of mass energies between 4.628 and 4.699 GeV, with a significance of 4.6 σ .

NODE=M259R03
NODE=M259R03

NODE=M259R03;LINKAGE=A

$T_{c\bar{c}1}(4000)$ REFERENCES

AAIJ	23AQ	PRL 131 131901	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	23BI	PRL 131 211902	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AE	PRL 129 112003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
ABLIKIM	21G	PRL 126 102001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ORTEGA	21	PL B818 136382	P.G. Ortega, D.R. Entem, F. Fernandez	

NODE=M259

REFID=62429
REFID=62434
REFID=61877
REFID=61150
REFID=61065
REFID=61108

 $T_{c\bar{c}}(4020)$

$$I^G(J^{PC}) = 1^+(\text{?}^-)$$

was $X(4020)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M213

NODE=M213

Charged $T_{c\bar{c}}(4020)$ seen by ABLIKIM 13X from $e^+e^- \rightarrow \pi^+\pi^-h_c(1P)$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $\pi^\pm h_c(1P)$ system, and by ABLIKIM 14B from $e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$ events in $(D^*\bar{D}^*)^\pm$ mass. A neutral $T_{c\bar{c}}(4020)$ seen by ABLIKIM 14P at three c.m. energies in the same range in $e^+e^- \rightarrow \pi^0\pi^0h_c(1P)$ as a peak in the larger of the two masses recoiling against a π^0 . ABLIKIM 15AA observes a 5.9σ signal in $(D^*\bar{D}^*)^0$ in $e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$ events using collisions at two c.m. energies. Production rates and mass values support grouping neutral and charged $T_{c\bar{c}}(4020)$ together as manifestations of a single $I = 1$ particle.

 $T_{c\bar{c}}(4020)$ MASS

NODE=M213M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
4024.1$\pm$1.9 OUR AVERAGE					
4025.5 $^{+2.0}_{-4.7}\pm 3.1$	116	¹ ABLIKIM	15AA	BES3 0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
4026.3 $\pm 2.6\pm 3.7$	401	¹ ABLIKIM	14B	BES3 $\pm$	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
4023.9 $\pm 2.2\pm 3.8$	61	^{1,2} ABLIKIM	14P	BES3 0	$e^+e^- \rightarrow \pi^0\pi^0h_c$
4022.9 $\pm 0.8\pm 2.7$	253	¹ ABLIKIM	13X	BES3 $\pm$	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

² Assuming $J^P = 1^+$ and width of 7.9 ± 2.6 MeV.

NODE=M213M

NODE=M213M;LINKAGE=AB
NODE=M213M;LINKAGE=B

 $T_{c\bar{c}}(4020)$ WIDTH

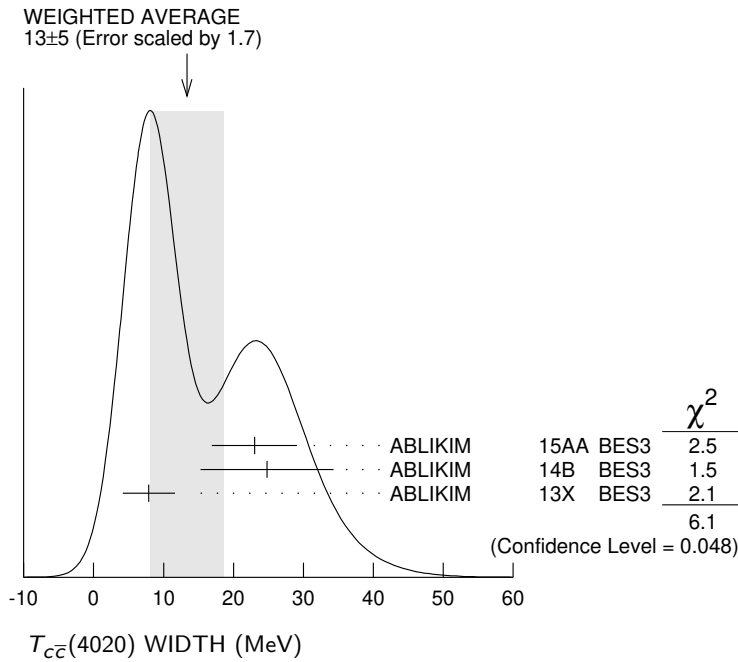
NODE=M213W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
13 $\pm$5 OUR AVERAGE					
Error includes scale factor of 1.7. See the ideogram below.					
23.0 $\pm 6.0\pm 1.0$	116	¹ ABLIKIM	15AA	BES3 0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
24.8 $\pm 5.6\pm 7.7$	401	¹ ABLIKIM	14B	BES3 $\pm$	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
7.9 $\pm 2.7\pm 2.6$	253	¹ ABLIKIM	13X	BES3 $\pm$	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

NODE=M213W

NODE=M213W;LINKAGE=AB



$T_{c\bar{c}}(4020)$ DECAY MODES

NODE=M213215;NODE=M213

Mode	Fraction (Γ_i/Γ)
Γ_1 $h_c(1P)\pi$	seen
Γ_2 $D^*\bar{D}^*$	seen
Γ_3 $D\bar{D}^* + \text{c.c.}$	not seen
Γ_4 $\eta_c\pi^+\pi^-$	not seen
Γ_5 $\eta_c(1S)\rho(770)^\pm$	
Γ_6 $J/\psi(1S)\pi^\pm$	not seen

DESIG=1

DESIG=2

DESIG=4

DESIG=3

DESIG=6

DESIG=5

$T_{c\bar{c}}(4020)$ BRANCHING RATIOS

NODE=M213225

$\Gamma(h_c(1P)\pi)/\Gamma_{\text{total}}$						Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	61	ABLIKIM	14P BES3	0	$e^+e^- \rightarrow \pi^0\pi^0 h_c$	
seen	253	ABLIKIM	13X BES3	$\pm$	$e^+e^- \rightarrow \pi^+\pi^- h_c$	

NODE=M213R01
NODE=M213R01

$\Gamma(D^*\bar{D}^*)/\Gamma_{\text{total}}$						Γ_2/Γ
VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
seen	116	¹ ABLIKIM	15AA BES3	0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$	
seen	401	¹ ABLIKIM	14B BES3	$\pm$	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$	

NODE=M213R02
NODE=M213R02¹ Neglecting interference between the $T_{c\bar{c}}(4020)$ and non-resonant continuum.

NODE=M213R02;LINKAGE=A

$\Gamma(D\bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
not seen	ABLIKIM	15AC BES3	$\pm$	$e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$		

NODE=M213R03
NODE=M213R03

$\Gamma(\eta_c\pi^+\pi^-)/\Gamma_{\text{total}}$						Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT			
not seen	¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+\eta_c\pi^+\pi^-$			

NODE=M213R00
NODE=M213R00¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ T_{c\bar{c}}(4020)^0) \times B(T_{c\bar{c}} \rightarrow \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ at 90% CL.

NODE=M213R00;LINKAGE=VI

$\Gamma(\eta_c(1S)\rho(770)^\pm)/\Gamma(h_c(1P)\pi)$						Γ_5/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<1.2	90	¹ ABLIKIM	19BC BES3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c(1S)$		

NODE=M213R05
NODE=M213R05¹ Using $e^+e^- \rightarrow \pi^\mp(Z_c(4020)^\pm \rightarrow h_c(1P)\pi^\pm)$ cross section at 4.23, 4.26 and 4.36 GeV from ABLIKIM 13X.

NODE=M213R05;LINKAGE=A

$\Gamma(J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM 17J BES3		$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ From Partial Wave Analysis assuming $J^P = 1^+$.

NODE=M213R04
 NODE=M213R04

NODE=M213R04;LINKAGE=A

 $T_{c\bar{c}}(4020)$ REFERENCES

ABLIKIM 19BC PR D100 111102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 17J PRL 119 072001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 15AA PRL 115 182002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 15AC PR D92 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
VINOKUROVA 15 JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
Also JHEP 1702 088 (errat.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)
ABLIKIM 14B PRL 112 132001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 14P PRL 113 212002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM 13X PRL 111 242001	M. Ablikim <i>et al.</i>	(BESIII Collab.)

NODE=M213

REFID=60036
 REFID=57950
 REFID=56951
 REFID=56967
 REFID=56706
 REFID=57795
 REFID=55654
 REFID=56118
 REFID=55635

NODE=M191

 $T_{c\bar{c}}(4050)^+$

$I^G(J^{PC}) = 1^-(?^?+)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE
 was $X(4050)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M191

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure.

 $T_{c\bar{c}}(4050)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4051 \pm 14^{+20}_{-41}$	¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191M

NODE=M191M

NODE=M191M;LINKAGE=MI

 $T_{c\bar{c}}(4050)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
82^{+21+47}_{-17-22}	¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191W

NODE=M191W

NODE=M191W;LINKAGE=MI

 $T_{c\bar{c}}(4050)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \pi^+\chi_{c1}(1P)$	seen
$\Gamma_2 \pi^\pm\psi(3770)$	not seen
$\Gamma_3 \pi^\pm\chi_{c0}(1P)$	not seen
$\Gamma_4 \pi^\pm\chi_{c2}(1P)$	not seen

NODE=M191215;NODE=M191

DESIG=1

DESIG=2

DESIG=3

DESIG=4

 $T_{c\bar{c}}(4050)^+$ BRANCHING RATIOS $\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen		¹ MIZUK 08 BELL		$\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen 16 ² ABLIKIM 21W BES3 $e^+e^- \rightarrow \chi_{cJ}\pi^+\pi^+$ not seen ³ LEES 12B BABR $B \rightarrow K\pi\chi_{c1}(1P)$

¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}}(4050)^+) \times B(T_{c\bar{c}}(4050)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.

² ABLIKIM 21W measurement is limited by statistics.

³ With a product branching fraction limit of $B(\bar{B}^0 \rightarrow T_{c\bar{c}}(4050)^+ K^-) \times B(T_{c\bar{c}}(4050)^+ \rightarrow \chi_{c1}\pi^+) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M191225

NODE=M191R01
 NODE=M191R01

NODE=M191R01;LINKAGE=MI

NODE=M191R01;LINKAGE=A

NODE=M191R01;LINKAGE=LE

$$\Gamma(\pi^\pm \chi_{c0}(1P))/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
not seen	18	¹ ABLIKIM	21W BES3	$e^+e^- \rightarrow \chi_{cJ} \pi^+ \pi^+$

¹ ABLIKIM 21W measurement is limited by statistics.

NODE=M191R02
NODE=M191R02

NODE=M191R02;LINKAGE=A

$$\Gamma(\pi^\pm \chi_{c2}(1P))/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
not seen	14	¹ ABLIKIM	21W BES3	$e^+e^- \rightarrow \chi_{cJ} \pi^+ \pi^+$

¹ ABLIKIM 21W measurement is limited by statistics.

NODE=M191R03
NODE=M191R03

NODE=M191R03;LINKAGE=A

$$\Gamma(\pi^\pm \psi(3770))/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+ \pi^- D \bar{D}$

¹ From a measurement of $\sigma(e^+e^- \rightarrow \pi^+ \pi^- D \bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.

NODE=M191R00
NODE=M191R00

NODE=M191R00;LINKAGE=A

$T_{c\bar{c}}(4050)^+$ REFERENCES

ABLIKIM	21W	PR D103 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

NODE=M191

REFID=61221
REFID=59910
REFID=54042
REFID=52535

NODE=M223

$T_{c\bar{c}}(4055)^+$

$I^G(J^{PC}) = 1^+(?^-)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $X(4055)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M223

Needs confirmation. Seen by WANG 15A in the $\psi(2S)\pi^+$ invariant mass distribution in $\psi(4360) \rightarrow \psi(2S)\pi^+\pi^-$ decay.

$T_{c\bar{c}}(4055)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4054 ±3 ±1	¹ WANG	15A BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4039.3 ± 6.0	² ABLIKIM	18K BES3	$e^+e^- \rightarrow \pi^0 \pi^0 \psi(2S)$
4032.1 ± 2.4	³ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$

¹ Statistical significance of 3.5σ .

² Statistical error only, with significance of 5.9σ (from a fit with a 19% CL). Identified as the same structure observed in ABLIKIM 17V in $e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$ decays.

³ Statistical error only, with significance of 9.2σ . From an unbinned maximum likelihood fit of the $\pi^+ \pi^- \psi(2S)$ Dalitz plot from data collected at $\sqrt{s} = 4.416$ GeV for a $J^C = 1^+$ state. The fit does not match the detailed structure of the data, having a C.L. of only 8%.

NODE=M223M

NODE=M223M

OCCUR=2

NODE=M223M;LINKAGE=A
NODE=M223M;LINKAGE=C

NODE=M223M;LINKAGE=B

$T_{c\bar{c}}(4055)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
45 ±11 ±6	¹ WANG	15A BELL	$10.58 e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
31.9 ± 14.8	² ABLIKIM	18K BES3	$e^+e^- \rightarrow \pi^0 \pi^0 \psi(2S)$
26.1 ± 5.3	³ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$

¹ Statistical significance of 3.5σ .

² Statistical error only, with significance of 5.9σ (from a fit with a 19% CL). Identified as the same structure observed in ABLIKIM 17V in $e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$ decays.

³ Statistical error only, with significance of 9.2σ . From an unbinned maximum likelihood fit of the $\pi^+ \pi^- \psi(2S)$ Dalitz plot from data collected at $\sqrt{s} = 4.416$ GeV for a $J^C = 1^+$ state. The fit does not match the detailed structure of the data, having a C.L. of only 8%.

NODE=M223W

NODE=M223W

NODE=M223W;LINKAGE=A
NODE=M223W;LINKAGE=C

NODE=M223W;LINKAGE=B

T_{c $\bar{c}$} (4055)⁺ DECAY MODES

NODE=M223215;NODE=M223

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\psi(2S)$	seen
Γ_2 $\pi^\pm\psi(3770)$	not seen

DESIG=1
DESIG=2

T_{c $\bar{c}$} (4055)⁺ BRANCHING RATIOS

NODE=M223225

$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID
seen	¹ WANG
	15A BELL
	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

¹ Statistical significance of 3.5 σ .

NODE=M223R01
NODE=M223R01

NODE=M223R01;LINKAGE=A

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$	Γ_2/Γ
VALUE	DOCUMENT ID
not seen	¹ ABLIKIM
	19AR BES3
	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$

¹ From a measurement of $\sigma(e^+e^- \rightarrow \pi^+\pi^-D\bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.

NODE=M223R00
NODE=M223R00

NODE=M223R00;LINKAGE=A

T_{c $\bar{c}$} (4055)⁺ REFERENCES

NODE=M223

ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18K	PR D97 052001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
Also		PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)

REFID=59910
REFID=58896
REFID=58029
REFID=59611
REFID=56839

NODE=M240

$T_{c\bar{c}}(4100)^+$

$I^G(J^{PC}) = 1^-(?^{?+})$

OMITTED FROM SUMMARY TABLE
was X(4100)[±]

NODE=M240

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Reported by AAIJ 18AN in the $\eta_c(1S)\pi^-$ invariant mass distribution in $B^0 \rightarrow \eta_c(1S)K^+\pi^-$ decays with a significance of 3.4 σ . $J^P = 0^+$ or 1^- assignment consistent with data.

T_{c $\bar{c}$} (4100)⁺ MASS

NODE=M240M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4096 \pm 20^{+18}_{-22}$	AAIJ	18AN LHCB	$B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240M

T_{c $\bar{c}$} (4100)⁺ WIDTH

NODE=M240W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
150^{+80}_{-70} OUR AVERAGE	[152^{+80}_{-70} MeV OUR 2023 AVERAGE]		
$152 \pm 58^{+60}_{-35}$	AAIJ	18AN LHCB	$B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240W

NEW

T_{c $\bar{c}$} (4100)⁺ DECAY MODES

NODE=M240215;NODE=M240

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta_c(1S)\pi^-$	seen
Γ_2 $\pi^\pm\psi(3770)$	not seen

DESIG=1
DESIG=2

$T_{c\bar{c}}(4100)^+$ BRANCHING RATIOS

$\Gamma(\eta_c(1S)\pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT
VALUE			
seen	¹ AAIJ	18AN LHCB	$B^0 \rightarrow \eta_c(1S)K^+\pi^-$
¹ AAIJ 18AN quotes a fit fraction for $B^0 \rightarrow T_{c\bar{c}}(4100)^-K^+ \rightarrow \eta_c(1S)\pi^-K^+$ of $(3.3 \pm 1.1^{+1.2}_{-1.1})\%$ from an amplitude analysis.			

NODE=M240225

NODE=M240R01
NODE=M240R01

NODE=M240R01;LINKAGE=A

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT
VALUE			
not seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$
¹ From a measurement of $\sigma(e^+e^- \rightarrow \pi^+\pi^-D\bar{D})$ between $\sqrt{s} = 4.08$ and 4.6 GeV.			

NODE=M240R00
NODE=M240R00

NODE=M240R00;LINKAGE=A

$T_{c\bar{c}}(4100)^+$ REFERENCES

ABLIKIM	19AR PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
AAIJ	18AN EPJ C78 1019	R. Aaij <i>et al.</i>	(LHCb Collab.)

NODE=M240

REFID=59910
REFID=59335

NODE=M231

$T_{c\bar{c}1}(4200)^+$	$I^G(J^{PC}) = 1^+(1^+-)$ I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE
was $Z_c(4200), X(4200)^\pm$

This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.

NODE=M231

Reported by CHILIKIN 14 in $J/\psi\pi^+$ at a significance of 6.2σ . As-
signments of $0^-, 1^-, 2^-$, and 2^+ excluded at $6.1\sigma, 7.4\sigma, 4.4\sigma$,
and 7.0σ level, respectively. Needs confirmation.

$T_{c\bar{c}1}(4200)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4196^{+31+17}_{-29-13}	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231M

NODE=M231M

$T_{c\bar{c}1}(4200)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$370 \pm 70^{+70}_{-132}$	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

NODE=M231W

NODE=M231W

$T_{c\bar{c}1}(4200)^+$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\pi^+$	seen

NODE=M231215;NODE=M231

DESIG=1

$T_{c\bar{c}1}(4200)^+$ BRANCHING RATIOS

$\Gamma(J/\psi\pi^+)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT
VALUE			
seen	CHILIKIN	14	BELL $\bar{B}^0 \rightarrow J/\psi K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	¹ AAIJ	19R LHCB	$B^0 \rightarrow K^+\pi^-J/\psi$ + c.c.
¹ From a model-independent analysis.			

NODE=M231220

NODE=M231R01
NODE=M231R01

NODE=M231R01;LINKAGE=C

$T_{c\bar{c}1}(4200)^+$ REFERENCES

AAIJ	19R PRL 122 152002	R. Aaij <i>et al.</i>	(LHCb Collab.)
CHILIKIN	14 PR D90 112009	K. Chilikin <i>et al.</i>	(BELLE Collab.)

NODE=M231

REFID=59776
REFID=56344

NODE=M260

$T_{c\bar{c}s1}(4220)^+$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE
was $Z_{cs}(4220)^+$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on "Heavy Non- $q\bar{q}$ Mesons."

NODE=M260

Seen by AAIJ 21E in $B^+ \rightarrow T_{c\bar{c}s1}(4220)^+ \phi$ with $T_{c\bar{c}s1}(4220)^+ \rightarrow J/\psi K^+$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 5.9σ . The $J^P = 1^+$ assignment is favored over 1^- with a significance of 2σ and other assignments are disfavored by 4.9σ .

$T_{c\bar{c}s1}(4220)^+$ MASS

NODE=M260M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
4220^{+50}_{-40} OUR AVERAGE		[4216^{+50}_{-40} MeV OUR 2023 AVERAGE]		
$4216 \pm 24^{+43}_{-30}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M260M

NEW

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260M;LINKAGE=A

$T_{c\bar{c}s1}(4220)^+$ WIDTH

NODE=M260W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
230^{+110}_{-90} OUR AVERAGE		[233^{+110}_{-90} MeV OUR 2023 AVERAGE]		
$233 \pm 52^{+97}_{-73}$	24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M260W

NEW

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260W;LINKAGE=A

$T_{c\bar{c}s1}(4220)^+$ DECAY MODES

NODE=M260215;NODE=M260

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad J/\psi K^+$	seen

DESIG=1

$\Gamma(J/\psi K^+)/\Gamma_{\text{total}}$	VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		24k	¹ AAIJ	21E LHCb	$B^+ \rightarrow J/\psi \phi K^+$	

NODE=M260R01
NODE=M260R01

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.9σ .

NODE=M260R01;LINKAGE=A

$T_{c\bar{c}s1}(4220)^+$ REFERENCES

NODE=M260

AAIJ	21E	PRL 127 082001	R. Aaij <i>et al.</i>	(LHCb Collab.) JP

REFID=61150

NODE=M216

$T_{c\bar{c}0}(4240)^+$

$I^G(J^{PC}) = 1^+(0^{--})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $R_{c0}(4240), X(4240)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M216

Spin and parity assignment $J^P = 0^-$ is favored over $1^-, 2^-$, and 2^+ by 8σ and over 1^+ by 1σ , according to the four-dimensional amplitude analysis of AAIJ 14AG.

$T_{c\bar{c}0}(4240)^+$ MASS

NODE=M216M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4239 \pm 18^{+45}_{-10}$	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$

NODE=M216M

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216M;LINKAGE=AA

$T_{c\bar{c}0}(4240)^+$ WIDTH

NODE=M216W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$220 \pm 47^{+108}_{-74}$	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$

NODE=M216W

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216W;LINKAGE=AA

$T_{c\bar{c}0}(4240)^+$ DECAY MODES

NODE=M216215;NODE=M216

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^- \psi(2S)$	seen

DESIG=1

$T_{c\bar{c}0}(4240)^+$ BRANCHING RATIOS

NODE=M216225

$\Gamma(\pi^- \psi(2S))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+ \pi^- \psi(2S)$	

NODE=M216R01
NODE=M216R01

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $T_{c\bar{c}1}(4430)$ fit. No partial branching fraction quoted.

NODE=M216R01;LINKAGE=AA

$T_{c\bar{c}0}(4240)^+$ REFERENCES

NODE=M216

AAIJ	14AG PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=55896

$T_{c\bar{c}}(4250)^+$

$I^G(J^{PC}) = 1^-(?^{?+})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE
was $X(4250)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Observed by MIZUK 08 in the $\pi^+\chi_{c1}(1P)$ invariant mass distribution in $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$ decays. Not seen by LEES 12B in this same mode after accounting for $K\pi$ resonant mass and angular structure.

NODE=M192

NODE=M192

$T_{c\bar{c}}(4250)^+$ MASS

NODE=M192M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4250^{+190}_{-50} OUR AVERAGE	[4248 $^{+190}_{-50}$ MeV OUR 2023 AVERAGE]		
$4248^{+44}_{-29}^{+180}_{-35}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192M

NEW

NODE=M192M;LINKAGE=MI

$T_{c\bar{c}}(4250)^+$ WIDTH

NODE=M192W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
180^{+320}_{-70} OUR AVERAGE	[177 $^{+320}_{-70}$ MeV OUR 2023 AVERAGE]		
$177^{+54}_{-39}^{+316}_{-61}$	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M192W

NEW

NODE=M192W;LINKAGE=MI

$T_{c\bar{c}}(4250)^+$ DECAY MODES

NODE=M192215;NODE=M192

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\chi_{c1}(1P)$	seen

DESIG=1

$T_{c\bar{c}}(4250)^+$ BRANCHING RATIOS

NODE=M192225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ MIZUK	08	BELL	$\overline{B}^0 \rightarrow K^- \pi^+ \chi_{c1}(1P)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	² LEES	12B	BABR	$B \rightarrow K \pi \chi_{c1}(1P)$
¹ With a product branching fraction measurement of $B(\overline{B}^0 \rightarrow K^- T_{c\overline{c}}(4250)^+) \times B(T_{c\overline{c}}(4250)^+ \rightarrow \pi^+ \chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.				
² With a product branching fraction limit of $B(\overline{B}^0 \rightarrow T_{c\overline{c}}(4250)^+ K^-) \times B(T_{c\overline{c}}(4250)^+ \rightarrow \chi_{c1} \pi^+) < 4.0 \times 10^{-5}$ at 90% CL.				

NODE=M192R01
NODE=M192R01

NODE=M192R01;LINKAGE=MI

NODE=M192R01;LINKAGE=LE

$T_{c\bar{c}}(4250)^+$ REFERENCES

NODE=M192

LEES	12B	PR D85 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MIZUK	08	PR D78 072004	R. Mizuk <i>et al.</i>	(BELLE Collab.)

REFID=54042
REFID=52535

$T_{c\bar{c}1}(4430)^+$

$I^G(J^{PC}) = 1^+(1^{+-})$
 G, C need confirmation.

was $Z_c(4430), X(4430)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

First seen by CHOI 08 in $B \rightarrow K\pi^+\psi(2S)$ decays, confirmed by AAIJ 14AG, and confirmed in a model-independent way by AAIJ 15BH. Also seen by CHILIKIN 14 in $B \rightarrow K^+\pi J/\psi$ decays. J^P was determined by CHILIKIN 13 and AAIJ 14AG.

NODE=M195

NODE=M195

$T_{c\bar{c}1}(4430)^+$ MASS

NODE=M195M

NODE=M195M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4478^{+15}_{-18} OUR AVERAGE			
$4475 \pm 7^{+15}_{-25}$	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$
$4485 \pm 22^{+28}_{-11}$	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4443^{+15+19}_{-12-13}	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
$4433 \pm 4 \pm 2$	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$
¹ From a four-dimensional amplitude analysis.			
² From a Dalitz plot analysis. Superseded by CHILIKIN 13.			
³ Superseded by MIZUK 09 and CHILIKIN 13.			

NODE=M195M;LINKAGE=A
NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH

$T_{c\bar{c}1}(4430)^+$ WIDTH

NODE=M195W

NODE=M195W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
181 ± 31 OUR AVERAGE			
$172 \pm 13^{+37}_{-34}$	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$
200^{+41+26}_{-46-35}	¹ CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
107^{+86+74}_{-43-56}	² MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$
45^{+18+30}_{-13-13}	³ CHOI	08 BELL	$B \rightarrow K\pi^+\psi(2S)$
¹ From a four-dimensional amplitude analysis.			
² From a Dalitz plot analysis. Superseded by CHILIKIN 13.			
³ Superseded by MIZUK 09 and CHILIKIN 13.			

NODE=M195W;LINKAGE=A
NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH

$T_{c\bar{c}1}(4430)^+$ DECAY MODES

NODE=M195215;NODE=M195

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\psi(2S)$	seen
$\Gamma_2 \quad \pi^+J/\psi$	seen

DESIG=1
DESIG=2

$T_{c\bar{c}1}(4430)^+$ BRANCHING RATIOS

NODE=M195225

$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+\pi^-\psi(2S)$	
seen	² CHILIKIN	13 BELL	$B^0 \rightarrow K^+\pi^-\psi(2S)$	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	³ AUBERT	09AA BABR	$B \rightarrow K\pi^+\psi(2S)$	
seen	⁴ MIZUK	09 BELL	$B \rightarrow K\pi^+\psi(2S)$	

NODE=M195R01
NODE=M195R01

¹ From a four-dimensional amplitude analysis. No product of branching fractions quoted.

² From a four-dimensional amplitude analysis. Measured a product of branching fractions

$$B(B^0 \rightarrow T_{c\bar{c}1}(4430)^- K^+) \times B(T_{c\bar{c}1}(4430)^- \rightarrow \psi(2S)\pi^-) = (6.0^{+1.7+2.5}_{-2.0-1.4}) \times 10^{-5}.$$

³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) < 4.7 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) < 3.1 \times 10^{-5}$ at 95% CL.

⁴ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ \psi(2S)) = (3.2^{+1.8+5.3}_{-0.9-1.6}) \times 10^{-5}$. Superseded by CHILIKIN 13.

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$

Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	1,2 CHILIKIN	14 BELL	$\bar{B}^0 \rightarrow K^- \pi^+ J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	³ AUBERT	09AA BABR	$B \rightarrow K \pi^+ J/\psi$
¹ CHILIKIN 14 reports $B(\bar{B}^0 \rightarrow T_{c\bar{c}1}(4430)^+ K^-) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow J/\psi \pi^+) = (5.4^{+4.0+1.1}_{-1.0-0.9}) \times 10^{-6}$.			
² A broad enhancement seen by AAIJ 19R in the decays $B^0 \rightarrow J/\psi \pi^+ K^-$ at 4600 MeV can be due to an interplay of $T_{c\bar{c}1}(4430)$, $T_{c\bar{c}1}(4200)$ and the fitting polynomials.			
³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- T_{c\bar{c}1}(4430)^+) \times B(T_{c\bar{c}1}(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

$T_{c\bar{c}1}(4430)^+$ REFERENCES

AAIJ	19R	PRL 122 152002	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	15BH	PR D92 112009	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	14AG	PRL 112 222002	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
CHILIKIN	14	PR D90 112009	K. Chilikin <i>et al.</i>	(BELLE Collab.)
CHILIKIN	13	PR D88 074026	K. Chilikin <i>et al.</i>	(BELLE Collab.) JP
AUBERT	09AA	PR D79 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)
MIZUK	09	PR D80 031104	R. Mizuk <i>et al.</i>	(BELLE Collab.)
CHOI	08	PRL 100 142001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)

$T_{b\bar{s}}(5568)^+$

$$I(J^P) = 1(?^?)$$

OMITTED FROM SUMMARY TABLE
was $X(5568)^\pm$

Seen as a peak in the $B_s \pi^\pm$ mass spectrum with a significance of more than 3σ by ABAZOV 16E and ABAZOV 18A in inclusive $p\bar{p}$ collisions at 1.96 TeV. Not seen by AAIJ 16AI, AABOUD 18L, AALTONEN 18A, and SIRUNYAN 18J. Needs confirmation.

$T_{b\bar{s}}(5568)^+$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
5566.9^{+3.2+0.6}_{-3.1-1.2}	278	¹ ABAZOV	18A D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5567.8 ^{±2.9+0.9} _{-1.9}	133	² ABAZOV	16E D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$

¹ From the combined analysis of $B_s^0 \rightarrow J/\psi \phi$ and $B_s^0 \rightarrow D_s^\pm \mu^\mp X$ decays.

² Assumes $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ decay. If $T_{b\bar{s}}(5568)^\pm \rightarrow B_s^* \pi^\pm$ decay is assumed, the mass shifts upward by 49 MeV.

$T_{b\bar{s}}(5568)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.6^{+7.9+3.5}_{-6.1-3.8}	278	¹ ABAZOV	18A D0	$p\bar{p} \rightarrow B_s \pi^\pm X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
21.9 ^{±6.4+5.0} _{-2.5}	133	ABAZOV	16E D0	$p\bar{p} \rightarrow B_s \pi^\pm X$

¹ From the combined analysis of $B_s^0 \rightarrow J/\psi \phi$ and $B_s^0 \rightarrow D_s^\pm \mu^\mp X$ decays.

NODE=M195R01;LINKAGE=AA
NODE=M195R01;LINKAGE=A

NODE=M195R01;LINKAGE=AU

NODE=M195R01;LINKAGE=MI

NODE=M195R02
NODE=M195R02

NODE=M195R02;LINKAGE=A

NODE=M195R02;LINKAGE=E

NODE=M195R02;LINKAGE=AU

NODE=M195

REFID=59776
REFID=57110
REFID=55896
REFID=56344
REFID=55551
REFID=52940
REFID=52960
REFID=52178

NODE=M232

NODE=M232

NODE=M232M

NODE=M232M

NODE=M232M;LINKAGE=B

NODE=M232M;LINKAGE=A

NODE=M232W

NODE=M232W

NODE=M232W;LINKAGE=B

$T_{b\bar{s}}(5568)^+$ DECAY MODES

NODE=M232215;NODE=M232

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B_s \pi^\pm$	seen

DESIG=1

 $T_{b\bar{s}}(5568)^+$ BRANCHING RATIOS

NODE=M232220

$\Gamma(B_s \pi^\pm)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVS	DOCUMENT ID	TECN	COMMENT	
seen	145	¹ ABAZOV	18A D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	
seen	133	² ABAZOV	16E D0	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		³ AABOUD	18L ATLS	$pp \rightarrow B_s^0 \pi^\pm X$	
not seen		⁴ AALTONEN	18A CDF	$p\bar{p} \rightarrow B_s^0 \pi^\pm X$	
not seen		⁵ SIRUNYAN	18J CMS	$pp \rightarrow B_s^0 \pi^\pm X$	
not seen		⁶ AAIJ	16AI LHCB	$pp \rightarrow B_s^0 \pi^\pm X$	

NODE=M232R01
NODE=M232R01

OCCUR=2

¹ With B_s mesons reconstructed in decays to $D_s^\pm \mu^\mp X$.NODE=M232R01;LINKAGE=F
NODE=M232R01;LINKAGE=A² Seen in $p\bar{p}$ collisions at 1.96 TeV at a rate of $(8.6 \pm 1.9 \pm 1.4)\%$ relative to inclusive B_s production in the kinematic region $10 < p_T(B_s) < 30$ GeV/c, with B_s mesons reconstructed in decays to $J/\psi\phi$. An alternative possibility, $T_{b\bar{s}}(5568)^\pm \rightarrow B_s^* \pi^\pm$ with a missing γ , could not be ruled out.³ Not seen in 24.4 fb^{-1} of pp collision data at $\sqrt{s} = 7$ and 8 TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.5% at $p_T(B_s) > 10$ GeV/c and less than 1.6% at $p_T(B_s) > 15$ GeV/c at 95% CL.

NODE=M232R01;LINKAGE=E

⁴ Not seen in 9.6 fb^{-1} of $p\bar{p}$ collision data at $\sqrt{s} = 1.96$ TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 6.7% at 95% CL.

NODE=M232R01;LINKAGE=D

⁵ Not seen in 19.7 fb^{-1} of pp collisions data at $\sqrt{s} = 8$ TeV with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.1% at $p_T(B_s) > 10$ GeV/c and less than 1.0% at $p_T(B_s) > 15$ GeV/c at 95%CL.

NODE=M232R01;LINKAGE=C

⁶ Not seen in 3 fb^{-1} of pp collision data at $\sqrt{s} = 7$ and 8 TeV in a scan over the $T_{b\bar{s}}(5568)$ mass and width, with B_s mesons reconstructed in decays to $D_s^\pm \pi^\mp$ or $J/\psi\phi$. An upper limit on the production rate times branching fraction for $T_{b\bar{s}}(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 2.1% at $p_T(B_s) > 10$ GeV/c at 90% CL.

NODE=M232R01;LINKAGE=B

 $T_{b\bar{s}}(5568)^+$ REFERENCES

NODE=M232

AABOUD	18L	PRL 120 202007	M. Aaboud <i>et al.</i>	(ATLAS Collab.)
AALTONEN	18A	PRL 120 202006	T. Aaltonen <i>et al.</i>	(CDF Collab.)
ABAZOV	18A	PR D97 092004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
SIRUNYAN	18J	PRL 120 202005	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	16AI	PRL 117 152003	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	16E	PRL 117 022003	V.M. Abazov <i>et al.</i>	(D0 Collab.)

REFID=58829
REFID=58828
REFID=58937
REFID=58827
REFID=57549
REFID=57453

$$T_{cc\bar{c}\bar{c}}(6900)^0$$

$$I^G(J^{PC}) = 0^+(?^{?+})$$

NODE=M268

OMITTED FROM SUMMARY TABLE
was $X(6900)$

State incompatible with a $q\bar{q}$ structure. See the review on "Heavy
Non- $q\bar{q}$ Mesons."

NODE=M268

$T_{cc\bar{c}\bar{c}}(6900)^0$ MASS

NODE=M268M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
6899±12 OUR AVERAGE	Error includes scale factor of 1.1. [6886 ± 16 MeV OUR 2023 AVERAGE]		
6910±10±10	¹ AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$
6886±11±11	² AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
6960±50±30	³ AAD	23BL ATLS	$pp \rightarrow J/\psi \psi(2S) X$
¹ In a model with two resonances, one describing the broad structure above threshold (mass $6650 \pm 20^{+30}_{-20}$ MeV, width $440 \pm 50^{+60}_{-50}$ MeV) interfering with single parton scattering, and a non-interfering $T_{cc\bar{c}\bar{c}}(6900)$.			
² In a model where the broad structure above threshold interferes with non-resonant single parton scattering. Without interference the mass is $6905 \pm 11 \pm 7$ MeV.			
³ Assuming a single resonance (could be another state). A 3σ signal is observed for an additional resonance with mass $7220 \pm 30^{+10}_{-40}$ MeV and width $90 \pm 60^{+60}_{-50}$ MeV.			

NODE=M268M
NEW

OCCUR=2

NODE=M268M;LINKAGE=B

NODE=M268M;LINKAGE=A

NODE=M268M;LINKAGE=C

$T_{cc\bar{c}\bar{c}}(6900)^0$ WIDTH

NODE=M268W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
153± 29 OUR AVERAGE	[168 ± 80 MeV OUR 2023 AVERAGE]		
150± 30± 10	¹ AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$
168± 33± 69	² AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
510±170 ⁺¹¹⁰ ₋₁₀₀	³ AAD	23BL ATLS	$pp \rightarrow J/\psi \psi(2S) X$
¹ In a model with two resonances, one describing the broad structure above threshold (mass $6650 \pm 20^{+30}_{-20}$ MeV, width $440 \pm 50^{+60}_{-50}$ MeV) interfering with single parton scattering, and a non-interfering $T_{cc\bar{c}\bar{c}}(6900)$.			
² In a model where the broad structure above threshold interferes with non-resonant single parton scattering. Without interference the width is 80 ± 38 MeV.			
³ Assuming a single resonance (could be another state). A 3σ signal is observed for an additional resonance with mass $7220 \pm 30^{+10}_{-40}$ MeV and width $90 \pm 60^{+60}_{-50}$ MeV.			

NODE=M268W
NEW

OCCUR=2

NODE=M268W;LINKAGE=B

NODE=M268W;LINKAGE=C

NODE=M268W;LINKAGE=D

$T_{cc\bar{c}\bar{c}}(6900)^0$ DECAY MODES

NODE=M268215;NODE=M268

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi J/\psi$	seen

DESIG=1

$\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$

 Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAD	23BL ATLS	$pp \rightarrow J/\psi J/\psi X$
seen	AAIJ	20AY LHCB	$pp \rightarrow J/\psi J/\psi X$

NODE=M268R00
NODE=M268R00

$T_{cc\bar{c}\bar{c}}(6900)^0$ REFERENCES

NODE=M268

AAD	23BL PRL 131 151902	G. Aad <i>et al.</i>	(ATLAS)
AAIJ	20AY SCIB 65 1983	R. Aaij <i>et al.</i>	(LHCb Collab.)

REFID=62432
REFID=61631

$T_{bb1}^-(10610)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

was $Z_b(10610)$, $X(10610)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

NODE=M207

NODE=M207

$T_{bb1}^-(10610)^\pm$ MASS

NODE=M207M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2$\pm$2.0	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10608.5 $\pm$ 3.4 $^{+3.7}_{-1.4}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10608.1 $\pm$ 1.2 $^{+1.5}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10607.4 $\pm$ 1.5 $^{+0.8}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10611 ± 4 ± 3	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10609 ± 2 ± 3	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10608 ± 2 ± 3	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10605 ± 2 $^{+3}_{-1}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10599 $^{+6}_{-3}$ $^{+5}_{-4}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207M

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

$T_{bb1}^-(10610)^0$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10609$\pm$4$\pm$4	¹ KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$
¹ From a simultaneous fit to the KROKOVNY 13 Dalitz analysis of $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$ decays with fixed width $\Gamma(T_{bb1}^-(10610)^0) = 18.4$ MeV.			

NODE=M207M;LINKAGE=BO

NODE=M207M;LINKAGE=A

NODE=M207M;LINKAGE=BN

NODE=M207M0

NODE=M207M0

NODE=M207M0;LINKAGE=A

$T_{bb1}^-(10610)^\pm$ WIDTH

NODE=M207W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4$\pm$ 2.4	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
18.5 $\pm$ 5.3 $^{+6.1}_{-2.3}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
20.8 $\pm$ 2.5 $^{+0.3}_{-2.1}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
18.7 $\pm$ 3.4 $^{+2.5}_{-1.3}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
22.3 $\pm$ 7.7 $^{+3.0}_{-4.0}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
24.2 $\pm$ 3.1 $^{+2.0}_{-3.0}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
17.6 $\pm$ 3.0 $\pm$ 3.0	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
11.4 $^{+4.5}_{-3.9}$ $^{+2.1}_{-1.2}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
13 $^{+10}_{-8}$ $^{+9}_{-7}$	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207W

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M207W;LINKAGE=BO

NODE=M207W;LINKAGE=A

NODE=M207W;LINKAGE=BN

$T_{b\bar{b}1}(10610)$ DECAY MODES

NODE=M207215;NODE=M207

Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	$(5.4^{+1.9}_{-1.5}) \times 10^{-3}$	DESIG=1
$\Gamma_2 \quad \Upsilon(1S)\pi^0$	not seen	DESIG=9
$\Gamma_3 \quad \Upsilon(2S)\pi^+$	$(3.6^{+1.1}_{-0.8}) \%$	DESIG=2
$\Gamma_4 \quad \Upsilon(2S)\pi^0$	seen	DESIG=10
$\Gamma_5 \quad \Upsilon(3S)\pi^+$	$(2.1^{+0.8}_{-0.6}) \%$	DESIG=3
$\Gamma_6 \quad \Upsilon(3S)\pi^0$	seen	DESIG=11
$\Gamma_7 \quad h_b(1P)\pi^+$	$(3.5^{+1.2}_{-0.9}) \%$	DESIG=4
$\Gamma_8 \quad h_b(2P)\pi^+$	$(4.7^{+1.7}_{-1.3}) \%$	DESIG=5
$\Gamma_9 \quad B^+\bar{B}^0$	not seen	DESIG=8
$\Gamma_{10} \quad B^+\bar{B}^{*0} + B^{*+}\bar{B}^0$	$(85.6^{+2.1}_{-2.9}) \%$	DESIG=6

 $T_{b\bar{b}1}(10610)$ BRANCHING RATIOS

NODE=M207225

 $\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$ NODE=M207R01
NODE=M207R01

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$5.4^{+1.6+1.1}_{-1.3-0.8}$	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$ $\pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M207R01;LINKAGE=A

 $\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$ NODE=M207R09
NODE=M207R09

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^0\pi^0$

 $\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$ NODE=M207R02
NODE=M207R02

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$3.62^{+0.76+0.79}_{-0.59-0.53}$	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$ $\pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M207R02;LINKAGE=A

 $\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$ NODE=M207R10
NODE=M207R10

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^0\pi^0$

¹ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .

NODE=M207R10;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$ NODE=M207R03
NODE=M207R03

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$2.15^{+0.55+0.60}_{-0.42-0.43}$	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$ $\pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
seen	BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M207R03;LINKAGE=A

$\Gamma(\Upsilon(3S)\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ KROKOVNY 13	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^0\pi^0$
¹ Combined significance in $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$, including systematics, of 6.5σ .			

NODE=M207R11
 NODE=M207R11

NODE=M207R11;LINKAGE=A

 $\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$3.45^{+0.87+0.86}_{-0.71-0.63}$	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	² MIZUK 16	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
seen	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

NODE=M207R04
 NODE=M207R04

NODE=M207R04;LINKAGE=C

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M207R04;LINKAGE=A

NODE=M207R04;LINKAGE=B

 $\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$4.67^{+1.24+1.18}_{-1.00-0.89}$	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
possibly seen	² MIZUK 16	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$
seen	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M207R05
 NODE=M207R05

NODE=M207R05;LINKAGE=C

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M207R05;LINKAGE=A

NODE=M207R05;LINKAGE=B

 $\Gamma(B^+ \bar{B}^0)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$

NODE=M207R08
 NODE=M207R08

 $[\Gamma(B^+ \bar{B}^{*0}) + \Gamma(B^{*+} \bar{B}^0)]/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$85.6^{+1.5+1.5}_{-2.0-2.1}$	357	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- B^{*+} \bar{B}^0$

NODE=M207R00
 NODE=M207R00

NODE=M207R00;LINKAGE=A

¹ Assuming the $T_{b\bar{b}1}(10610)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $T_{b\bar{b}1}(10610)$ from BONDAR 12.

$$\frac{[\Gamma(B^+ \bar{B}^{*0}) + \Gamma(B^{*+} \bar{B}^0)]}{[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)]} \quad \Gamma_{10}/(\Gamma_1 + \Gamma_3 + \Gamma_5 + \Gamma_7 + \Gamma_8)$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.93^{+0.99+1.01}_{-0.69-0.73}$	357	¹ GARMASH 16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$

NODE=M207R07
 NODE=M207R07

NODE=M207R07;LINKAGE=A

¹ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $T_{b\bar{b}1}(10610)$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$.

 $T_{b\bar{b}1}(10610)$ REFERENCES

NODE=M207

GARMASH 16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=57446
MIZUK 16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=57465
GARMASH 15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=56811
KROKOVNY 13	PR D88 052016	P. Krokovny <i>et al.</i>	(BELLE Collab.)	REFID=55588
BONDAR 12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)	REFID=53963

$$T_{b\bar{b}1}(10650)^+$$

$$I^G(J^{PC}) = 1^+(1^+ -)$$

 $I, G, C \text{ need confirmation.}$

was $Z_b(10650), X(10650)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Observed by BONDAR 12 in $\Upsilon(5S)$ decays to $\Upsilon(nS)\pi^+\pi^-$ ($n = 1, 2, 3$) and $h_b(mP)\pi^+\pi^-$ ($m = 1, 2$). $J^P = 1^+$ is favored from angular analyses.

NODE=M208

NODE=M208

$T_{b\bar{b}1}(10650)^+$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10652.2$\pm$1.5	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10656.7 $\pm$ 5.0 $^{+1.1}_{-3.1}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10650.7 $\pm$ 1.5 $^{+0.5}_{-0.2}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10651.2 $\pm$ 1.0 $^{+0.4}_{-0.3}$	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10657 $\pm 6 \pm 3$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
10651 $\pm 2 \pm 3$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
10652 $\pm 1 \pm 2$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
10654 $\pm 3 \pm 1$ -2	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10651 $^{+2}_{-3} \pm 3$ -2	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M208M

NODE=M208M

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M208M;LINKAGE=BO

NODE=M208M;LINKAGE=A

NODE=M208M;LINKAGE=BN

$T_{b\bar{b}1}(10650)^+$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
11.5$\pm$ 2.2	¹ BONDAR 12	BELL	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
12.1 $^{+11.3}_{-4.8} \pm 2.7$ -0.6	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
14.2 $\pm 3.7 \pm 0.9$ -0.4	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
9.3 $\pm 2.2 \pm 0.3$ -0.5	² GARMASH 15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
16.3 $\pm 9.8 \pm 6.0$ -2.0	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
13.3 $\pm 3.3 \pm 4.0$ -3.0	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
8.4 $\pm 2.0 \pm 2.0$	³ BONDAR 12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
20.9 $^{+5.4}_{-4.7} \pm 2.1$ -5.7	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
19 $\pm 7 \pm 11$ -7	³ BONDAR 12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Average of the BONDAR 12 measurements in separate channels.

² Correlated with the corresponding result from BONDAR 12.

³ Superseded by the average measurement of BONDAR 12.

NODE=M208W

NODE=M208W

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

NODE=M208W;LINKAGE=BO

NODE=M208W;LINKAGE=A

NODE=M208W;LINKAGE=BN

$T_{b\bar{b}1}(10650)^+$ DECAY MODES

$T_{b\bar{b}1}(10650)^-$ decay modes are charge conjugates of the modes below.

NODE=M208215;NODE=M208

NODE=M208

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	$(1.7^{+0.8}_{-0.6}) \times 10^{-3}$
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	$(1.4^{+0.6}_{-0.4}) \%$
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	$(1.6^{+0.7}_{-0.5}) \%$

DESIG=1

DESIG=2

DESIG=3

Γ_4	$h_b(1P)\pi^+$	$(8.4^{+2.9}_{-2.4})\%$	DESIG=4
Γ_5	$h_b(2P)\pi^+$	$(15 \pm 4)\%$	DESIG=5
Γ_6	$B^+\bar{B}^0$	not seen	DESIG=8
Γ_7	$B^+\bar{B}^{*0} + B^{*+}\bar{B}^0$	not seen	DESIG=6
Γ_8	$B^{*+}\bar{B}^{*0}$	$(74^{+4}_{-6})\%$	DESIG=7

$T_{b\bar{b}1}(10650)^+$ BRANCHING RATIOS

$\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$1.7^{+0.7+0.3}_{-0.6-0.2}$	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208225

NODE=M208R01
NODE=M208R01

NODE=M208R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$1.39^{+0.48+0.34}_{-0.38-0.23}$	¹ GARMASH	16	$e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R02
NODE=M208R02

NODE=M208R02;LINKAGE=A

$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$1.63^{+0.53+0.39}_{-0.42-0.28}$	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	GARMASH	15	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
seen	BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

NODE=M208R03
NODE=M208R03

NODE=M208R03;LINKAGE=A

$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$8.41^{+2.43+1.49}_{-2.12-1.06}$	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	² MIZUK	16	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
seen	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R04
NODE=M208R04

NODE=M208R04;LINKAGE=C

NODE=M208R04;LINKAGE=A
NODE=M208R04;LINKAGE=B

$\Gamma(h_b(2P)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$14.7^{+3.2+2.8}_{-2.8-2.3}$	¹ GARMASH	16	BELL $e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

possibly seen	² MIZUK	16	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$
seen	³ BONDAR	12	BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+\Upsilon(1S, 2S, 3S)$, $\pi^+h_b(1P, 2P)$, and $B^{*+}\bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16.

² Using e^+e^- energies near the $\Upsilon(11020)$.

³ Using e^+e^- energies near the $\Upsilon(10860)$.

NODE=M208R05
NODE=M208R05

NODE=M208R05;LINKAGE=C

NODE=M208R05;LINKAGE=A
NODE=M208R05;LINKAGE=B

$\Gamma(B^+\bar{B}^0)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	GARMASH	16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^0$	

NODE=M208R08
NODE=M208R08

$[\Gamma(B^+\bar{B}^{*0}) + \Gamma(B^{*+}\bar{B}^0)]/\Gamma_{\text{total}}$					Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
not seen	GARMASH	16	BELL	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0},$ $\pi^- \bar{B}^0 B^{*+}$	

NODE=M208R00
NODE=M208R00

$\Gamma(B^{*+}\bar{B}^{*0})/\Gamma_{\text{total}}$					Γ_8/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
$73.7^{+3.4+2.7}_{-4.4-3.5}$	161	¹ GARMASH	16	BELL	$e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

NODE=M208R06
NODE=M208R06

¹ Assuming the $T_{b\bar{b}1}(10650)$ decay width is saturated by the channels $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$, and using the results from BONDAR 12 and MIZUK 16. Using the mass and width of the $T_{b\bar{b}1}(10650)$ from BONDAR 12.

NODE=M208R06;LINKAGE=A

$\Gamma(B^{*+}\bar{B}^{*0})/[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)]$					$\Gamma_8/(\Gamma_1+\Gamma_2+\Gamma_3+\Gamma_4+\Gamma_5)$
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M208R07
NODE=M208R07

• • • We do not use the following data for averages, fits, limits, etc. • • •

$2.80^{+0.69+0.54}_{-0.40-0.36}$	161	¹ GARMASH	16	BELL	$e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$

¹ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $T_{b\bar{b}1}(10650)$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$.

NODE=M208R07;LINKAGE=A

$T_{b\bar{b}1}(10650)^+$ REFERENCES

NODE=M208

GARMASH	16	PRL 116 212001	A. Garmash <i>et al.</i>	(BELLE Collab.)
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)
GARMASH	15	PR D91 072003	A. Garmash <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

REFID=57446
REFID=57465
REFID=56811
REFID=53963

Further States

NODE=M300

OMITTED FROM SUMMARY TABLE

This section contains states observed by a single group or states poorly established that thus need confirmation.

NODE=M300

QUANTUM NUMBERS, MASSES, WIDTHS, AND BRANCHING RATIOS

$X(360)$	$I^G(J^{PC}) = ?^?(?^{?+})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$360 \pm 7 \pm 9$	64 ± 18	2.3k	¹ ABRAAMYAN	09	CNTR $2.75 d C \rightarrow \gamma\gamma X$

NODE=M300K08
NODE=M300K08

¹ Not seen in $p C \rightarrow \gamma\gamma X$ at 5.5 GeV/c.

NODE=M300K08;LINKAGE=AB

$X(1070)$	$I^G(J^{PC}) = ?^?(0^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	COMMENT		
1072 ± 1	3.5 ± 0.5	¹ VLADIMIRSK...08	40 $\pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$		

NODE=M300J07
NODE=M300J07

¹ Supersedes GRIGOR'EV 05.

NODE=M300J07;LINKAGE=VL

$X(1110)$	$I^G(J^{PC}) = 0^+(\text{even}^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1107 ± 4	$111 \pm 8 \pm 15$	DAFTARI	87	DBC	0. $\bar{p} n \rightarrow \rho^- \pi^+ \pi^-$

NODE=M300J30
NODE=M300J30

$f_0(1200-1600)$	$I^G(J^{PC}) = 0^+(0^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1323 ± 8	237 ± 20	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	
1480^{+100}_{-150}	1030^{+80}_{-170}	¹ ANISOVICH	03	SPEC	
1530^{+90}_{-250}	560 ± 40	² ANISOVICH	03	SPEC	

NODE=M300J98
NODE=M300J98

OCCUR=2

- ¹ K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ at rest, $\bar{p} n \rightarrow \pi^- \pi^- \pi^+$, $K_S^0 K^- \pi^0$, $K_S^0 K_S^0 \pi^-$ at rest.
- ² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$ at rest.

NODE=M300;LINKAGE=KM

NODE=M300;LINKAGE=MK

X(1420) $I^G(J^{PC}) = 2^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1420 ± 20	160 ± 10	FILIPPI	00	OBLX	0 $\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$

NODE=M300J61
NODE=M300J61

X(1545) $I^G(J^{PC}) = ?^?(?^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	COMMENT		
1545 ± 3	6.0 ± 2.5	¹ VLADIMIRSK...08	40	$\pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$	

NODE=M300K07
NODE=M300K07¹ Supersedes VLADIMIRSKII 00.

NODE=M300K07;LINKAGE=VL

X(1575) $I^G(J^{PC}) = ?^?(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1576 ⁺⁴⁹⁺⁹⁸ ₋₅₅₋₉₁	818 ⁺²²⁺⁶⁴ ₋₂₃₋₁₃₃	¹ ABLIKIM	06S	BES	$J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M300J08
NODE=M300J08

¹ A broad peak observed at $K^+ K^-$ invariant mass. Mass and width above are its pole position. The observed branching ratio is $B(J/\psi \rightarrow X \pi^0) B(X \rightarrow K^+ K^-) = (8.5 \pm 0.6^{+2.7}_{-3.6}) \times 10^{-4}$.

NODE=M300J08;LINKAGE=AB

X(1600) $I^G(J^{PC}) = 2^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1600 ± 100	400 ± 200	¹ ALBRECHT 91F	ARG	10.2	$e^+ e^- \rightarrow e^+ e^- 2(\pi^+ \pi^-)$

NODE=M300J99
NODE=M300J99¹ Our estimate.

NODE=M300J99;LINKAGE=A

X(1650) $I^G(J^{PC}) = 0^-(?^{?-})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1652 ± 7	<50	100	PROKOSHKIN 96	GAM2	32,38 $\pi p \rightarrow \omega \eta n$

NODE=M300J62
NODE=M300J62

X(1730) $I^G(J^{PC}) = ?^?(?^{?+})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1731.0 ± 1.2 ± 2.0	3.2 ± 0.8 ± 1.3	58	VLADIMIRSK...07	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 X$

NODE=M300K06
NODE=M300K06

f₂(1750) $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1755 ± 10	67 ± 12	870	¹ SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$

NODE=M300JAM
NODE=M300JAM

Γ(K$\bar{K}$)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
17 ± 5	870	² SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA1
NODE=M300JA1

Γ(γγ)					
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.13 ± 0.04	870	² SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA2
NODE=M300JA2

Γ(ππ)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.3 ± 1.0	870	² SCHEGELSKY 06A	RVUE	$\gamma \gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA3
NODE=M300JA3

$\Gamma(\eta\eta)$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.0±0.5	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ From analysis of L3 data at 91 and 183–209 GeV.² From analysis of L3 data at 91 and 183–209 GeV and using SU(3) relations.NODE=M300JA4
NODE=M300JA4NODE=M300JAM;LINKAGE=SC
NODE=M300JA;LINKAGE=SC $X(1775) \quad I^G(J^{PC}) = 1^-(?^{-}+)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1763±20	192 ± 60	CONDO 91	SHF	$\gamma p \rightarrow (p\pi^+)(\pi^+\pi^-\pi^-)$
1787±18	118 ± 60	CONDO 91	SHF	$\gamma p \rightarrow n\pi^+\pi^+\pi^-$

NODE=M300J60
NODE=M300J60

OCCUR=2

 $X(1850 - 3100) \quad I^G(J^{PC}) = ?^?(1^{-}-)$

$\Gamma(e^+e^-) \cdot B(X \rightarrow \text{hadrons})$ (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<120	90	¹ ANASHIN 11	KEDR	$e^+e^- \rightarrow \text{hadrons}$

¹ This limit is center-of-mass energy dependent. We quote the most stringent one.NODE=M300K28
NODE=M300K28

NODE=M300K28;LINKAGE=AN

 $X(1855) \quad I^G(J^{PC}) = ?^?(?^{??})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1856.6±5	20 ± 5	BRIDGES 86D	SPEC	0. $\bar{p}d \rightarrow \pi\pi N$

NODE=M300J31
NODE=M300J31 $X(1870) \quad I^G(J^{PC}) = ?^?(2^{??})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1870±40	250 ± 30	ALDE 86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J45
NODE=M300J45 $a_3(1875) \quad I^G(J^{PC}) = 1^-(3^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1874±43±96	385 ± 121 ± 114	CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

NODE=M300J95
NODE=M300J95 $B(a_3(1875) \rightarrow f_2(1270)\pi)/B(a_3(1875) \rightarrow \rho\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.8±0.2	¹ CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

¹ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.NODE=M300B7
NODE=M300B7

NODE=M300B;LINKAGE=C1

 $B(a_3(1875) \rightarrow \rho_3(1690)\pi)/B(a_3(1875) \rightarrow \rho\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.9±0.3	¹ CHUNG 02	B852	18.3 $\pi^- p \rightarrow \pi^+\pi^-\pi^- p$

¹ Using the observable fractions of 50.0% $\rho\pi$, 56.5% $f_2\pi$, and 11.8% $\rho_3\pi$.NODE=M300B8
NODE=M300B8

NODE=M300B8;LINKAGE=C1

 $a_1(1930) \quad I^G(J^{PC}) = 1^-(1^{++})$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1930 ⁺³⁰ ₋₇₀	155 ± 45	ANISOVICH 01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J92
NODE=M300J92 $X(1935) \quad I^G(J^{PC}) = 1^+(1^{-}?)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1935±20	215 ± 30	EVANGELIS... 79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J33
NODE=M300J33 $\rho_2(1940) \quad I^G(J^{PC}) = 1^+(2^{-}-)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1940±40	155 ± 40	¹ ANISOVICH 02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.NODE=M300J85
NODE=M300J85

NODE=M300J85;LINKAGE=AY

 $\omega_3(1945) \quad I^G(J^{PC}) = 0^-(3^{-}-)$

MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
1945±20	115 ± 22	¹ ANISOVICH 02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J65
NODE=M300J65

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J65;LINKAGE=AZ

$a_2(1950)$		$I^G(J^{PC}) = 1^-(2^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1950^{+30}_{-70}	180^{+30}_{-70}	¹ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$	

NODE=M300K24
NODE=M300K24

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K24;LINKAGE=AN

$\omega(1960)$		$I^G(J^{PC}) = 0^-(1^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1960 ± 25	195 ± 60	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$	

NODE=M300J79
NODE=M300J79

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J79;LINKAGE=AZ

$b_1(1960)$		$I^G(J^{PC}) = 1^+(1^{+-})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1960 ± 35	230 ± 50	¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$	

NODE=M300J67
NODE=M300J67

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J67;LINKAGE=AY

$h_1(1965)$		$I^G(J^{PC}) = 0^-(1^{+-})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1965 ± 45	345 ± 75	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$	

NODE=M300J64
NODE=M300J64

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J64;LINKAGE=AZ

$f_1(1970)$		$I^G(J^{PC}) = 0^+(1^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1971 ± 15	240 ± 45	ANISOVICH	00J	SPEC		

NODE=M300J1
NODE=M300J1

$X(1970)$		$I^G(J^{PC}) = ?^?(???)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1970 ± 10	40 ± 20	CHLIAPNIK...	80	HBC	32 $K^+p \rightarrow 2K_S^0 2\pi X$	

NODE=M300J46
NODE=M300J46

$X(1975)$		$I^G(J^{PC}) = ?^?(???)$				
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	
1973 ± 15	80	30	CASO	70	HBC	$11.2 \pi^- p \rightarrow \rho 2\pi$

NODE=M300J47
NODE=M300J47

$\omega_2(1975)$		$I^G(J^{PC}) = 0^-(2^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT		
1975 ± 20	175 ± 25	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$	

NODE=M300J81
NODE=M300J81

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J81;LINKAGE=AZ

$a_2(1990)$		$I^G(J^{PC}) = 1^-(2^{++})$				
MASS (MeV)	WIDTH (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT	
$2050 \pm 10 \pm 40$	$190 \pm 22 \pm 100$	18k	¹ SCHEGELSKY	06	RVUE	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$
$2003 \pm 10 \pm 19$	$249 \pm 23 \pm 32$		LU	05	B852	$18 \pi^- p \rightarrow \omega\pi^-\pi^0 p$

NODE=M300J2
NODE=M300J2

¹ From analysis of L3 data at 183–209 GeV.

NODE=M300J2;LINKAGE=SC

$\Gamma(\gamma\gamma) \Gamma(\pi^+ \pi^- \pi^0) / \Gamma(\text{total})$					
<u>VALUE (keV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$0.11 \pm 0.04 \pm 0.05$	18k	¹ SCHEGELSKY 06	RVUE	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	
¹ From analysis of L3 data at 183–209 GeV.					

NODE=M300J2G
NODE=M300J2G

NODE=M300J2G;LINKAGE=SC

$\rho(2000) \quad I^G(J^{PC}) = 1^+(1^- -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2000 ± 30	260 ± 45	¹ BUGG	04C	RVUE	Compilation
~ 1988	~ 244	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$
¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.					

NODE=M300J77
NODE=M300J77

NODE=M300;LINKAGE=AY

$f_2(2000) \quad I^G(J^{PC}) = 0^+(2^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2001 ± 10	312 ± 32	ANISOVICH	00J	SPEC	
~ 1996	~ 134	HASAN	94	RVUE	$\bar{p}p \rightarrow \pi\pi$

NODE=M300J25
NODE=M300J25

$X(2000) \quad I^G(J^{PC}) = 1^-(?^? +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
1964 ± 35	225 ± 50	¹ ARMSTRONG	93D	E760	$\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
~ 2100	~ 500	¹ ANTIPOV	77	CIBS	$-$ $25 \pi^- p \rightarrow p \pi^- \rho_3$
2214 ± 15	355 ± 21	² BALTAY	77	HBC	0 $15 \pi^- p \rightarrow \Delta^{++} 3\pi$
2080 ± 40	340 ± 80	KALELKAR	75	HBC	$+$ $15 \pi^+ p \rightarrow p \pi^+ \rho_3$
¹ Cannot determine spin to be 3.					
² BALTAY 77 favors $J^P = ,3^+$.					

NODE=M300K01
NODE=M300K01

NODE=M300K01;LINKAGE=AA
NODE=M300K01;LINKAGE=B

$X(2000) \quad I^G(J^{PC}) = ?^?(4^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$1998 \pm 3 \pm 5$	<15	VLADIMIRSK...03	SPEC	$\pi^- p \rightarrow K_S^0 K_S^0 M M$	

NODE=M300J97
NODE=M300J97

$\eta(2010) \quad I^G(J^{PC}) = 0^+(0^- +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2010^{+35}_{-60}	270 ± 60	ANISOVICH	00J	SPEC	

NODE=M300J5
NODE=M300J5

$\pi_1(2015) \quad I^G(J^{PC}) = 1^-(1^- +)$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2014 \pm 20 \pm 16$	$230 \pm 32 \pm 73$	145k	LU	05	B852 $18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$2001 \pm 30 \pm 92$	$333 \pm 52 \pm 49$	69k	KUHN	04	B852 $18 \pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300J05
NODE=M300J05

$a_0(2020) \quad I^G(J^{PC}) = 1^-(0^+ +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 30	330 ± 75	ANISOVICH	99C	SPEC	

NODE=M300J6
NODE=M300J6

$X(2020) \quad I^G(J^{PC}) = ?^?(?^?)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2015 ± 3	10 ± 4	FERRER	99	RVUE	$\pi p \rightarrow p \bar{p} \pi(\pi)$

NODE=M300J34
NODE=M300J34

$h_3(2025) \quad I^G(J^{PC}) = 0^-(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2025 ± 20	145 ± 30	¹ ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p} \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J78
NODE=M300J78

NODE=M300J78;LINKAGE=AZ

$b_3(2030) \quad I^G(J^{PC}) = 1^+(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2032 ± 12	117 ± 11	¹ ANISOVICH	02	SPEC	$0.6\text{--}1.9 \bar{p} \bar{p} \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$

NODE=M300J69
NODE=M300J69

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J69;LINKAGE=AY

$a_2(2030)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2030 ± 20	205 ± 30	¹ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K23
NODE=M300K23

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K23;LINKAGE=AN

$a_3(2030)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2031 ± 12	150 ± 18	¹ ANISOVICH	01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K20
NODE=M300K20

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K20;LINKAGE=AN

$\eta_2(2030)$ $I^G(J^{PC}) = 0^+(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2030 ± 5 ± 15	205 ± 10 ± 15	ANISOVICH	00E	SPEC	

NODE=M300J8
NODE=M300J8

$B(a_2\pi)_{L=0}/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.05 ± 0.03	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B1
NODE=M300B1

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B1;LINKAGE=AN

$B(a_0\pi)/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.10 ± 0.08	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B2
NODE=M300B2

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B2;LINKAGE=AN

$B(f_2\eta)/B(a_2\pi)_{L=2}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.13 ± 0.06	¹ ANISOVICH	11	SPEC 0.9–1.94 $p\bar{p}$

NODE=M300B3
NODE=M300B3

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M300B3;LINKAGE=AN

$f_3(2050)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2048 ± 8	213 ± 34	ANISOVICH	00J	SPEC	2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$

NODE=M300J7
NODE=M300J7

$f_0(2060)$ $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
~ 2050	~ 120	¹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 2060	~ 50	¹ OAKDEN	94	RVUE	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$

NODE=M300J59
NODE=M300J59

¹ See SEMENOV 99 and KLOET 96.

OCCUR=2

NODE=M300J;LINKAGE=A

$\pi(2070)$ $I^G(J^{PC}) = 1^-(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2070 ± 35	310 $^{+100}_{-50}$	ANISOVICH	01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J91
NODE=M300J91

$X(2075)$ $I^G(J^{PC}) = ?^?(1^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2084 $^{+4}_{-2} \pm 9$	58 $^{+4}_{-3} \pm 25$	^{1,2} ABLIKIM	23BG	BES3	$e^+e^- \rightarrow pK^-\bar{\Lambda}$
2075 ± 12 ± 5	90 ± 35 ± 9	³ ABLIKIM	04J	BES2	$J/\psi \rightarrow K^-\bar{p}\bar{\Lambda}$

NODE=M300J01
NODE=M300J01

- ¹ The reported mass and width are the pole positions in the complex (M, Γ) plane.
- ² Signal observed with a statistical significance $>20\sigma$ comes from 3883 candidate events. Spin parity determined to be $J^P = 1^+$ with a statistical significance $>5\sigma$ over $0^-, 1^-, 2^+$ hypotheses, and in the range within $3.1\text{--}7.5\sigma$ with respect to 2^- .
- ³ From a fit in the region $M_{p\bar{\Lambda}} - M_{p\bar{\Lambda}} < 150\text{ MeV}$. S -wave in the $p\bar{\Lambda}$ system preferred. A similar near-threshold enhancement in the $p\bar{\Lambda}$ system is observed in $B^+ \rightarrow p\bar{\Lambda}\bar{D}^0$ by CHEN 11F.

NODE=M300J01;LINKAGE=A
NODE=M300J01;LINKAGE=B

NODE=M300J01;LINKAGE=AB

X(2080) $I^G(J^{PC}) = ?^?(??)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2080 ± 10	110 ± 20	KREYMER	80	STRC 13 $\pi^- d \rightarrow p\bar{p}n(n_s)$

NODE=M300J35
NODE=M300J35

X(2080) $I^G(J^{PC}) = ?^?(3^-)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2080 ± 10	190 ± 15	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p\bar{p}n$

NODE=M300J37
NODE=M300J37

a₁(2095) $I^G(J^{PC}) = 1^-(1^+)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2096 ± 17 ± 121	451 ± 41 ± 81	69k	KUHN	04 B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^-p$

NODE=M300J04
NODE=M300J04

B(a₁(2095) → f₁(1285)π) / B(a₁(2095) → a₁(1260))		DOCUMENT ID	TECN	COMMENT
VALUE	EVTS			
3.18 ± 0.64	69k	KUHN	04	B852 18 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^-p$

NODE=M300B03
NODE=M300B03

η(2100) $I^G(J^{PC}) = 0^+(0^-)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2050 ⁺³⁰⁺⁷⁵ ₋₂₄₋₂₆	250 ⁺³⁶⁺¹⁸¹ ₋₃₀₋₁₆₄		1	ABLIKIM 16N BES3 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2103 ± 50	187 ± 75	586	2	BISELLO 89B DM2 $J/\psi \rightarrow 4\pi\gamma$

NODE=M300J48
NODE=M300J48

¹ From a partial wave analysis of $J/\psi \rightarrow \gamma\phi\phi$, for which the primary signal is $\eta(2225) \rightarrow \phi\phi$, and that also finds significant signals for for 0^-+ phase space, $f_0(2100)$, $f_2(2010)$, $f_2(2300)$, $f_2(2340)$, and a previously unseen 0^-+ state $X(2500)$ ($M = 2470^{+15+101}_{-19-23}$ MeV, $\Gamma = 230^{+64+56}_{-35-33}$ MeV).

NODE=M300J48;LINKAGE=A

² ASTON 81B sees no peak, has 850 events in Ajinenko+Barth bins. ARESTOV 80 sees no peak.

NODE=M300J;LINKAGE=A1

X(2100) $I^G(J^{PC}) = ?^?(0^{??})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2100 ± 40	250 ± 40	ALDE	86D	GAM4 100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110) $I^G(J^{PC}) = 1^+(3^-)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG 10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J36
NODE=M300J36

X(2120) $I^G(J^{PC}) = ?^?(0^{??})$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2122.4 ± 6.7 ^{+4.7} _{-2.7}	83 ± 16 ⁺³¹ ₋₁₁	647	ABLIKIM	11C BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M300A07
NODE=M300A07

f₂(2140) $I^G(J^{PC}) = 0^+(2^+)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)	EVTS		
2141 ± 12	49 ± 28	389	GREEN	86 MPSF 400 $pA \rightarrow 4KX$

NODE=M300J50
NODE=M300J50

X(2150) $I^G(J^{PC}) = ?^?(2^+)$		DOCUMENT ID	TECN	COMMENT
MASS (MeV)	WIDTH (MeV)			
2150 ± 10	260 ± 10	ROZANSKA	80	SPRK 18 $\pi^- p \rightarrow p\bar{p}n$

NODE=M300J38
NODE=M300J38

$a_2(2175)$ $I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2175 ± 40	310 ⁺⁹⁰ ₋₄₅	ANISOVICH	01F SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$	

NODE=M300J88
NODE=M300J88

$\eta(2190)$ $I^G(J^{PC}) = 0^+(0^{-+})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
2190 ± 50	850 ± 100	BUGG	99 BES	

NODE=M300J13
NODE=M300J13

$\omega_2(2195) \quad I^G(J^{PC}) = 0^-(2^{--})$					
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2195 ± 30	225 ± 40	¹ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$	
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J82
NODE=M300J82

NODE=M300J82;LINKAGE=AZ

$X(2210)$ $I^G(J^{PC}) = ?^?(??)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ⁺⁷⁹ ₋₂₁	203 ⁺⁴³⁷ ₋₈₇	EVANGELIS...	79B OMEG	10 $\pi^- p \rightarrow K^+ K^- n$	
2207 ± 22	130	CASO	70 HBC	11.2 $\pi^- p$	

NODE=M300J51
NODE=M300J51

$X_2(2210)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2210 ± 60	360 ± 120	¹ KLEMP	22 RVUE	$J/\psi \rightarrow \gamma\pi^0\pi^0,$ $\gamma K_S^0 K_S^0$	

NODE=M300A05
NODE=M300A05

¹ Fit of the tensor partial waves from BES3 in the multipole basis. Might be a cluster of $J^{PC} = 2^{++}$ resonances. The ratio of decay widths $K K^- / \pi\pi$ is 0.23 ± 0.05 .

NODE=M300A05;LINKAGE=A

$h_1(2215)$ $I^G(J^{PC}) = 0^-(1^{+-})$					
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
2215±40	325 ± 55	¹ ANISOVICH	02B SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$	
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J27
NODE=M300J27

NODE=M300J27;LINKAGE=AZ

$\rho_2(2225)$ $I^G(J^{PC}) = 1^+(2^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2225 ± 35	335 ⁺¹⁰⁰ ₋₅₀	¹ ANISOVICH	02 SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0,$ $\omega\eta\pi^0, \pi^+\pi^-$	

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J70
NODE=M300J70

NODE=M300J70;LINKAGE=AY

$\rho_4(2230)$ $I^G(J^{PC}) = 1^+(4^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2230 ± 25	210 ± 30	¹ ANISOVICH	02 SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0,$ $\omega\eta\pi^0, \pi^+\pi^-$	

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J74
NODE=M300J74

NODE=M300J74;LINKAGE=AY

$b_1(2240)$ $I^G(J^{PC}) = 1^+(1^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 35	320 ± 85	¹ ANISOVICH	02 SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0,$ $\omega\eta\pi^0, \pi^+\pi^-$	

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J87
NODE=M300J87

NODE=M300J87;LINKAGE=AY

$f_2(2240)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2240 ± 15	241 ± 30	¹ ANISOVICH	00J SPEC	1.92–2.41 $p\bar{p}$	

NODE=M300K26
NODE=M300K26

• • • We do not use the following data for averages, fits, limits, etc. • • •

~ 2226 ~ 226 HASAN 94 RVUE $p\bar{p} \rightarrow \pi\pi$

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K26;LINKAGE=AN

$b_3(2245)$		$I^G(J^{PC}) = 1^+(3^-)$	
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN
2245 ± 50	320 ± 70	¹ BUGG 04C	RVUE

NODE=M300K10
NODE=M300K10

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

$\eta_2(2250)$		$I^G(J^{PC}) = 0^+(2^-)$	
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN
2248 ± 20	280 ± 20	ANISOVICH 00I	SPEC
2267 ± 14	290 ± 50	ANISOVICH 00J	SPEC

NODE=M300J17
NODE=M300J17

$\pi_4(2250)$		$I^G(J^{PC}) = 1^-(4^-)$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 15	215 ± 25	ANISOVICH 01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$

NODE=M300J73
NODE=M300J73

$\omega_4(2250)$		$I^G(J^{PC}) = 0^-(4^-)$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2250 ± 30	150 ± 50	¹ ANISOVICH 02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J84
NODE=M300J84

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250)$		$I^G(J^{PC}) = 0^-(5^-)$	
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN
2250 ± 70	320 ± 95	¹ BUGG 04	RVUE

NODE=M300K11
NODE=M300K11

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300;LINKAGE=AZ

$\omega_3(2255)$		$I^G(J^{PC}) = 0^-(3^-)$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 15	175 ± 30	¹ ANISOVICH 02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J66
NODE=M300J66

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J66;LINKAGE=AZ

$a_4(2255)$		$I^G(J^{PC}) = 1^-(4^+)$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2237 ± 5	291 ± 12	UMAN 06	E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2255 ± 40	330 ⁺¹¹⁰ ₋₅₀	¹ ANISOVICH 01F	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K21
NODE=M300K21

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

NODE=M300K21;LINKAGE=AN

$a_2(2255)$		$I^G(J^{PC}) = 1^-(2^+)$		
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2255 ± 20	230 ± 15	¹ ANISOVICH 01G	SPEC	1.96–2.41 $\bar{p}p$

NODE=M300K22
NODE=M300K22

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K22;LINKAGE=AN

$X(2260)$		$I^G(J^{PC}) = 0^+(4^?)$	
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN
2260 ± 20	400 ± 100	EVANGELIS... 79	OMEG 10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J40
NODE=M300J40

$\rho(2270)$		$I^G(J^{PC}) = 1^+(1^-)$	
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN
2265 ± 40	325 ± 80	¹ ANISOVICH 02	SPEC
2280 ± 50	440 ± 110	ATKINSON 85	OMEG 20–70 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$

NODE=M300J86
NODE=M300J86

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J86;LINKAGE=AY

$a_1(2270)$ $I^G(J^{PC}) = 1^-(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2270^{+55}_{-40}	305^{+70}_{-40}	ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$

NODE=M300J72
NODE=M300J72

$h_3(2275)$ $I^G(J^{PC}) = 0^-(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 25	190 ± 45	¹ ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p} \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J28
NODE=M300J28

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J28;LINKAGE=AZ

$a_3(2275)$ $I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 35	350^{+100}_{-50}	¹ ANISOVICH	01G	SPEC	$1.96\text{--}2.41 \bar{p} p$

NODE=M300K19
NODE=M300K19

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.

NODE=M300K19;LINKAGE=AN

$\pi_2(2285)$ $I^G(J^{PC}) = 1^-(2^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
$2285 \pm 20 \pm 25$	$250 \pm 20 \pm 25$	¹ ANISOVICH	11	SPEC	$0.9\text{--}1.94 \bar{p} \bar{p}$

NODE=M300K25
NODE=M300K25

¹ Reanalysis of ADOEIT 96 and ANISOVICH 00E.

NODE=M300K25;LINKAGE=AN

$\omega_3(2285)$ $I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2278 ± 28	224 ± 50	¹ BUGG	04A	RVUE	
2285 ± 60	230 ± 40	² ANISOVICH	02B	SPEC	$0.6\text{--}1.9 \bar{p} \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J83
NODE=M300J83

¹ Partial wave analysis of the data on $\bar{p} \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M300J83;LINKAGE=BU

² From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J83;LINKAGE=AZ

$\omega(2290)$ $I^G(J^{PC}) = 0^-(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2290 ± 20	275 ± 35	¹ BUGG	04A	RVUE	

NODE=M300J02
NODE=M300J02

¹ Partial wave analysis of the data on $\bar{p} \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M300J02;LINKAGE=BU

$f_2(2295)$ $I^G(J^{PC}) = 0^+(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2293 ± 13	216 ± 37	¹ ANISOVICH	00J	SPEC	$1.92\text{--}2.41 \bar{p} \bar{p}$

NODE=M300K27
NODE=M300K27

¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K27;LINKAGE=AN

$f_3(2300)$ $I^G(J^{PC}) = 0^+(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2334 ± 25	200 ± 20	¹ BUGG	04A	RVUE	

NODE=M300J19
NODE=M300J19

¹ Partial wave analysis of the data on $\bar{p} \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.

NODE=M300J19;LINKAGE=BU

$f_1(2310)$ $I^G(J^{PC}) = 0^+(1^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2310 ± 60	255 ± 70	ANISOVICH	00J	SPEC	

NODE=M300J23
NODE=M300J23

$\eta(2320)$ $I^G(J^{PC}) = 0^+(0^{-+})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2320 ± 15	230 ± 35	¹ ANISOVICH	00M	SPEC	

NODE=M300J18
NODE=M300J18

¹ From the combined analysis of $\bar{p}p \rightarrow \eta\eta\eta$ from ANISOVICH 00M and $\bar{p}p \rightarrow \eta\pi^0\pi^0$ from ANISOVICH 00J.

NODE=M300;LINKAGE=B

$\eta_4(2330)$ $I^G(J^{PC}) = 0^+(4^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2328 ± 38	240 ± 90	ANISOVICH 00J	SPEC	2.0 $p\bar{p} \rightarrow \eta\pi^0\pi^0$	

NODE=M300J22
NODE=M300J22

$\omega(2330)$ $I^G(J^{PC}) = 0^-(1^--)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2330 ± 30	435 ± 75	ATKINSON 88	OMEG	25-50 $\gamma p \rightarrow \rho^\pm \rho^0 \pi^\mp$	

NODE=M300J53
NODE=M300J53

$X(2340)$ $I^G(J^{PC}) = ?^?(?^{??})$					
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2340 ± 20	180 ± 60	126	¹ BALTAY	75	HBC 15 $\pi^+ p \rightarrow p 5\pi$

NODE=M300J54
NODE=M300J54

¹ Dominant decay into $\rho^0 \rho^0 \pi^+$. BALTAY 78 finds confirmation in $2\pi^+ \pi^- 2\pi^0$ events which contain $\rho^+ \rho^0 \pi^0$ and $2\rho^+ \pi^-$.

NODE=M300J;LINKAGE=B1

$\pi(2360)$ $I^G(J^{PC}) = 1^-(0^-+)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 25	300 ⁺¹⁰⁰ ₋₅₀	ANISOVICH 01F	SPEC	2.0 $\bar{p}p \rightarrow 3\pi^0, \pi^0\eta, \pi^0\eta'$	

NODE=M300J90
NODE=M300J90

$X(2360)$ $I^G(J^{PC}) = ?^?(4^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2360 ± 10	430 ± 30	ROZANSKA 80	SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J42
NODE=M300J42

• • • We do not use the following data for averages, fits, limits, etc. • • •

2356 ± 7 ± 15	304 ± 28 ± 54	¹ ABLIKIM	23AY	BES3	$e^+e^- \rightarrow (\Lambda\bar{\Lambda})\eta$

¹ Assuming $J^{PC} = 1^--$.

NODE=M300J42;LINKAGE=A

$X(2440)$ $I^G(J^{PC}) = ?^?(5^{-?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2440 ± 10	310 ± 20	ROZANSKA 80	SPRK	18 $\pi^- p \rightarrow p\bar{p}n$	

NODE=M300J43
NODE=M300J43

$a_6(2450)$ $I^G(J^{PC}) = 1^-(6^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2450 ± 130	400 ± 250	CLELAND 82B	SPEC	50 $\pi p \rightarrow K_S^0 K^\pm p$	

NODE=M300K12
NODE=M300K12

$X(2540)$ $I^G(J^{PC}) = 0^+(0^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2539 ± 14 ⁺³⁸ ₋₁₄	274 ⁺⁷⁷⁺¹²⁶ ₋₆₁₋₁₆₃	UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300K30
NODE=M300K30

$\Gamma(\gamma\gamma) \times B(K\bar{K})$					
VALUE (eV)		DOCUMENT ID	TECN	COMMENT	
40 ⁺⁹⁺¹⁷ ₋₇₋₄₀		UEHARA	13	BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

NODE=M300K3G
NODE=M300K3G

$X(2600)$ $I^G(J^{PC}) = ?^?(?^{??})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2618.3 ± 2.0 ^{+16.3} _{-1.4}	195 ± 5 ⁺²⁶ ₋₁₇	ABLIKIM	22G	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M300A01
NODE=M300A01

$B(J/\psi \rightarrow \gamma X(2600)) \times B(X(2600) \rightarrow f_0(1500)\eta') \times B(f_0(1500) \rightarrow \pi^+\pi^-)$					
VALUE (units 10 ⁻⁵)		DOCUMENT ID	TECN	COMMENT	
3.09 ± 0.21 ^{+1.14} _{-0.77}		¹ ABLIKIM	22G	BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M300A02
NODE=M300A02

¹ The $\pi^+\pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.

NODE=M300A02;LINKAGE=A

$B(J/\psi \rightarrow \gamma X(2600)) \times B(X(2600) \rightarrow X(1540)\eta') \times B(X(1540) \rightarrow \pi^+ \pi^-)$				
<u>VALUE (units 10^{-5})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$2.69 \pm 0.19^{+0.38}_{-1.21}$	¹ ABLIKIM	22G BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$	
¹ The $\pi^+ \pi^-$ mass spectrum is described by a coherent sum of two Breit-Wigner resonances, $f_0(1500)$ and a new $X(1540)$ with mass $1540.2 \pm 7.0^{+36.3}_{-6.1}$ MeV and width $157 \pm 19^{+11}_{-77}$ MeV.				

NODE=M300A03
NODE=M300A03

NODE=M300A03;LINKAGE=A

$K_0^*(2600) \quad I(J^P) = 1/2(0^+)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
$2662 \pm 59 \pm 201$	$480 \pm 47 \pm 72$	¹ AAIJ	23AH LHCB	$B^+ \rightarrow K^+(K_S^0 K \pi)$
¹ From Dalitz plot analyses of $\eta_c(1S, 2S) \rightarrow K_S^0 K^+ \pi^- + c.c..$				

NODE=M300A09
NODE=M300A09

NODE=M300A09;LINKAGE=A

$X(2632) \quad I^G(J^{PC}) = ?^?(???)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2635.2 ± 3.3		¹ EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^+ \eta$
2631.6 ± 2.1	< 17	² EVDOKIMOV	04 SELX	$X(2632) \rightarrow D_s^0 K^+$
¹ From a mass difference to D_s^+ of 666.9 ± 3.3 MeV.				
² From a mass difference to D_s^0 of 767.0 ± 2.0 MeV.				

NODE=M300J03
NODE=M300J03

OCCUR=2

NODE=M300J03;LINKAGE=EV
NODE=M300J03;LINKAGE=ED

$B(X(2632) \rightarrow D^0 K^+)/B(X(2632) \rightarrow D_s^+ \eta)$		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
0.14 ± 0.06	¹ EVDOKIMOV	04 SELX
¹ Possible interpretation of this decay pattern is discussed by YASUI 07.		

NODE=M300B01
NODE=M300B01

NODE=M300B01;LINKAGE=YA

$X(2680) \quad I^G(J^{PC}) = ?^?(???)$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2676 ± 27	150	CASO	70 HBC	$11.2 \pi^- p \rightarrow \rho^- \pi^+ \pi^- p$

NODE=M300J55
NODE=M300J55

$X(2710) \quad I^G(J^{PC}) = ?^?(6^{+?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2710 ± 20	170 ± 40	ROZANSKA	80 SPRK	$18 \pi^- p \rightarrow p \bar{p} n$

NODE=M300J44
NODE=M300J44

$X(2750) \quad I^G(J^{PC}) = ?^?(7^{-?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
2747 ± 32	195 ± 75	DENNEY	83 LASS	$10 \pi^+ p \rightarrow K^+ K^- \pi^+ p$

NODE=M300J56
NODE=M300J56

$f_6(3100) \quad I^G(J^{PC}) = 0^+(6^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
3100 ± 100	700 ± 130	BINON	05 GAMS	$33 \pi^- p \rightarrow \eta \eta n$

NODE=M300J06
NODE=M300J06

$X(3250) \quad I^G(J^{PC}) = ?^?(???)$ 3-Body Decays				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
$3250 \pm 8 \pm 20$	45 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+$
$3265 \pm 7 \pm 20$	40 ± 18	ALEEV	93 BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^-$

NODE=M300J57
NODE=M300J57

OCCUR=2

$X(3250) \quad I^G(J^{PC}) = ?^?(???)$ 4-Body Decays				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT
$3245 \pm 8 \pm 20$	25 ± 11	ALEEV	93 BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+ \pi^\pm$
$3250 \pm 9 \pm 20$	50 ± 20	ALEEV	93 BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^- \pi^\mp$
$3270 \pm 8 \pm 20$	25 ± 11	ALEEV	93 BIS2	$X(3250) \rightarrow K_S^0 p \bar{p} K^\pm$

NODE=M300J58
NODE=M300J58

OCCUR=2

OCCUR=3

X(3350)		$I^G(J^{PC}) = ?^?(???)$			
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$3350^{+10}_{-20} \pm 20$	$70^{+40}_{-30} \pm 40$	50 ± 10	¹ GABYSHEV	06A BELL	$B^- \rightarrow \Lambda_c^+ \bar{p} \pi^-$

NODE=M300J09
NODE=M300J09

¹ A similar enhancement in the $\Lambda_c^+ \bar{p}$ final state is also reported by BABAR collaboration in AUBERT 10H.

NODE=M300J09;LINKAGE=AU

$\psi(4500)$	$I^G(J^{PC}) = 0^-(1^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
4469.1 ± 26.2 ± 3.6	246.3 ± 36.7 ± 9.4	¹ ABLIKIM	23X BES3	$e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$	
4484.7 ± 13.3 ± 24.1	111.1 ± 30 ± 15.2	² ABLIKIM	22AU BES3	$e^+ e^- \rightarrow K^+ K^- J/\psi$	

NODE=M300K39
NODE=M300K39

¹ From a cross-section measurement of $e^+ e^- \rightarrow D^{*0} D^{*-} \pi^+$ between 4.189 and 4.951 GeV, assuming a coherent sum of 3 Breit-Wigner resonances plus a continuum amplitude. $\Gamma(e^+ e^-) \cdot B(D^{*0} D^{*-} \pi^+) = 107\text{--}1744$ eV depending on solutions I – VIII with the same fit qualities. The two other resonances have masses (widths) 4209.6 ± 7.5 (81.6 ± 19.9) MeV and 4675.3 ± 29.7 (218.3 ± 73.5) MeV.

NODE=M300K39;LINKAGE=A

² ABLIKIM 22AU cross sections analysis of the process $e^+ e^- \rightarrow K^+ K^- J/\psi$ at c.m. energies 4.127–4.600 GeV from 15.6 fb^{-1} of data.

NODE=M300K39;LINKAGE=B

REFERENCES for Further States

NODE=M300

AAIJ	23AH	PR D108 032010	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=62349
ABLIKIM	23AY	PR D107 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62066
ABLIKIM	23BG	PRL 131 151901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62431
ABLIKIM	23X	PRL 130 121901	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=62072
ABLIKIM	22AU	CP C46 111002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61896
ABLIKIM	22G	PRL 129 042001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=61642
KLEMP	22	PL B830 137171	E. Klempt <i>et al.</i>	(BONN)	REFID=61646
ABLIKIM	16N	PR D93 112011	M. Ablikim	(BESIII Collab.)	REFID=57512
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=55592
ANISOVICH	12	PR D85 014001	A.V. Anisovich <i>et al.</i>		REFID=53961
ABLIKIM	11C	PRL 106 072002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53684
ANASHIN	11	PL B703 543	V.V. Anashin <i>et al.</i>	(KEDR Collab.)	REFID=53932
ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)	REFID=53631
CHEN	11F	PR D84 071501	P. Chen <i>et al.</i>	(BELLE Collab.)	REFID=53814
AUBERT	10H	PR D82 031102	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53363
ABRAAMYAN	09	PR C80 034001	Kh.U. Abraamyan <i>et al.</i>		REFID=53100
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirovsky <i>et al.</i>	(ITEP)	REFID=52681
VLADIMIRSK...	07	Translated from YAF 71 2166.	V. Vladimirovsky <i>et al.</i>		REFID=52058
YASUI	07	PR D76 034009	S. Yasui, M. Oka		REFID=51907
ABLIKIM	06S	PRL 97 142002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=51451
GABYSHEV	06A	PRL 97 242001	N. Gabyshev <i>et al.</i>	(BELLE Collab.)	REFID=51565
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>		REFID=51186
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>		REFID=51185
UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)	REFID=51063
VLADIMIRSK...	06	PAN 69 493	V.V. Vladimirovsky <i>et al.</i>	(ITEP, Moscow)	REFID=51191
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
GRIGOR'EV	05	Translated from YAF 68 998.	V.K. Grigor'ev <i>et al.</i>	(ITEP)	REFID=50844
LU	05	PRL 94 032002	M. Lu <i>et al.</i>	(BNL E852 Collab.)	REFID=50459
ABLIKIM	04J	PRL 93 112002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50196
BUGG	04	PL B595 556 (errat.)	D.V. Bugg		REFID=49763
BUGG	04A	EPJ C36 161	D.V. Bugg		REFID=50158
BUGG	04C	PRPL 397 257	D.V. Bugg		REFID=50203
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)	REFID=50337
KUHN	04	PL B595 109	J. Kuhn <i>et al.</i>	(BNL E852 Collab.)	REFID=49773
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
VLADIMIRSK...	03	PAN 66 700	V.V. Vladimirovsky <i>et al.</i>		REFID=49419
ANISOVICH	02	PL B542 8	A.V. Anisovich <i>et al.</i>		REFID=48828
ANISOVICH	02B	PL B542 19	A.V. Anisovich <i>et al.</i>		REFID=48829
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)	REFID=48837
ANISOVICH	01C	PL B507 23	A.V. Anisovich <i>et al.</i>		REFID=48325
ANISOVICH	01D	PL B508 6	A.V. Anisovich <i>et al.</i>		REFID=48327
ANISOVICH	01E	PL B513 281	A.V. Anisovich <i>et al.</i>		REFID=48349
ANISOVICH	01F	PL B517 261	A.V. Anisovich <i>et al.</i>		REFID=48352
ANISOVICH	01G	PL B517 273	A.V. Anisovich <i>et al.</i>		REFID=48353
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>		REFID=47942
ANISOVICH	00D	PL B476 15	A.V. Anisovich <i>et al.</i>		REFID=47944
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>		REFID=47945
ANISOVICH	00I	PL B491 40	A.V. Anisovich <i>et al.</i>		REFID=47949
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)	REFID=47950
ANISOVICH	00M	PL B496 145	A.V. Anisovich <i>et al.</i>		REFID=48009
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>		REFID=47965
FILIPPI	00	PL B495 284	A. Filippi <i>et al.</i>	(OBELIX Experiment)	REFID=48006
VLADIMIRSKII	00	JETPL 72 486	V.V. Vladimirovskii <i>et al.</i>		REFID=47997
ANISOVICH	99C	Translated from ZETFP 72 698.	A.V. Anisovich <i>et al.</i>		REFID=46903
ANISOVICH	99E	PL B452 173	A.V. Anisovich <i>et al.</i>		REFID=46902
ANISOVICH	99F	NP A651 253	A.V. Anisovich <i>et al.</i>		REFID=46926
ANISOVICH	99J	PL B471 271	A.V. Anisovich <i>et al.</i>		REFID=47416
ANISOVICH	99K	PL B468 309	A.V. Anisovich <i>et al.</i>		REFID=47472
BUGG	99	PL B458 511	D.V. Bugg <i>et al.</i>		REFID=46938
FERRER	99	EPJ C10 249	A. Ferrer <i>et al.</i>		REFID=47404
SEME NOV	99	SPU 42 847	S.V. Semenov		REFID=47363
ADOMEIT	96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45202
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)	REFID=45212
PROKOSHKIN	96	PD 41 247	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=45182
Translated from DANS 348 481.					

HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)	REFID=44103
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)	REFID=45210
ALEEV	93	PAN 56 1358	A.N. Aleev <i>et al.</i>	(BIS-2 Collab.)	REFID=43668
		Translated from YAF 56 100.			
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43596
ALBRECHT	91F	ZPHY C50 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41658
CONDO	91	PR D43 2787	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)	REFID=41588
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
ATKINSON	88	ZPHY C38 535	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=40556
DAFTARI	87	PRL 58 859	I.K. Daftari <i>et al.</i>	(SYRA)	REFID=40412
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)	REFID=20765
BRIDGES	86D	PL B180 313	D.L. Bridges <i>et al.</i>	(SYRA, BNL, CASE+)	REFID=21984
GREEN	86	PRL 56 1639	D.R. Green <i>et al.</i>	(FNAL, ARIZ, FSU+)	REFID=21872
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=22000
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)	REFID=20754
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
ASTON	81B	NP B189 205	D. Aston <i>et al.</i>	(BONN, CERN, EPOL, GLAS+)	REFID=11553
ARESTOV	80	IHEP 80-165	Y.I. Arestov <i>et al.</i>	(SERP)	REFID=22312
CHLIAPNIK...	80	ZPHY C3 285	P.V. Chliapnikov <i>et al.</i>	(SERP, BRUX, MONS)	REFID=21996
KREYMER	80	PR D22 36	A.E. Kreymer <i>et al.</i>	(IND, PURD, SLAC+)	REFID=21970
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)	REFID=21774
EVANGELIS...	79	NP B153 253	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21966
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=21967
BALTAY	78	PR D17 52	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21569
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)	REFID=20728
BALTAY	77	PRL 39 591	C. Baltay, C.V. Cautis, M. Kalelkar	(COLU)	REFID=20847
BALTAY	75	PRL 35 891	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21994
KALELKAR	75	Thesis Nevis 207	M.S. Kalelkar	(COLU)	REFID=21564
CASO	70	LNC 3 707	C. Caso <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=20590
