

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

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

NODE=MXXX005

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$f_0(500)$

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

also known as σ ; was $f_0(600)$
See the related review(s):
[Scalar Mesons below 2 GeV](#)

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

NODE=M014PP

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→ UNCHECKED ←

Note that $\Gamma \approx 2 \text{Im}(\sqrt{s_{\text{pole}}})$.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(400–550)–i(200–350) OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(512 \pm 15) - i(188 \pm 12)$	¹ ABLIKIM	17	BES3 $J/\psi \rightarrow \gamma 3\pi$
$(440 \pm 10) - i(238 \pm 10)$	² ALBALADEJO	12	RVUE Compilation
$(445 \pm 25) - i(278^{+22}_{-18})$	^{3,4} GARCIA-MAR..	11	RVUE Compilation
$(457^{+14}_{-13}) - i(279^{+11}_{-7})$	^{3,5} GARCIA-MAR..	11	RVUE Compilation
$(442^{+5}_{-8}) - i(274^{+6}_{-5})$	⁶ MOUSSALLAM	11	RVUE Compilation
$(452 \pm 13) - i(259 \pm 16)$	⁷ MENNESSIER	10	RVUE Compilation
$(448 \pm 43) - i(266 \pm 43)$	⁸ MENNESSIER	10	RVUE Compilation
$(455 \pm 6^{+31}_{-13}) - i(278 \pm 6^{+34}_{-43})$	⁹ CAPRINI	08	RVUE Compilation
$(463 \pm 6^{+31}_{-17}) - i(259 \pm 6^{+33}_{-34})$	¹⁰ CAPRINI	08	RVUE Compilation
$(552^{+84}_{-106}) - i(232^{+81}_{-72})$	¹¹ ABLIKIM	07A	BES2 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$
$(466 \pm 18) - i(223 \pm 28)$	¹² BONVICINI	07	CLEO $D^+ \rightarrow \pi^- \pi^+ \pi^+$
$(472 \pm 30) - i(271 \pm 30)$	¹³ BUGG	07A	RVUE Compilation
$(484 \pm 17) - i(255 \pm 10)$	GARCIA-MAR..	07	RVUE Compilation
$(430) - i(325)$	¹⁴ ANISOVICH	06	RVUE Compilation
$(441^{+16}_{-8}) - i(272^{+9}_{-12.5})$	¹⁵ CAPRINI	06	RVUE $\pi\pi \rightarrow \pi\pi$
$(470 \pm 50) - i(285 \pm 25)$	¹⁶ ZHOU	05	RVUE
$(541 \pm 39) - i(252 \pm 42)$	¹⁷ ABLIKIM	04A	BES2 $J/\psi \rightarrow \omega \pi^+ \pi^-$
$(528 \pm 32) - i(207 \pm 23)$	¹⁸ GALLEGOS	04	RVUE Compilation
$(533 \pm 25) - i(249 \pm 25)$	¹⁹ BUGG	03	RVUE
$517 - i240$	BLACK	01	RVUE $\pi^0 \pi^0 \rightarrow \pi^0 \pi^0$
$(470 \pm 30) - i(295 \pm 20)$	¹⁵ COLANGELO	01	RVUE $\pi\pi \rightarrow \pi\pi$
$(535^{+48}_{-36}) - i(155^{+76}_{-53})$	²⁰ ISHIDA	01	$\Upsilon(3S) \rightarrow \Upsilon \pi\pi$
$610 \pm 14 - i620 \pm 26$	²¹ 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 $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$
$(1530^{+90}_{-250}) - i(560 \pm 40)$	ANISOVICH	98B	RVUE Compilation
$420 - i212$	LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$440 - i245$	²² DOBADO	97	RVUE Compilation
$(602 \pm 26) - i(196 \pm 27)$	²³ ISHIDA	97	$\pi\pi \rightarrow \pi\pi$
$(537 \pm 20) - i(250 \pm 17)$	²⁴ KAMINSKI	97B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, 4\pi$
$470 - i250$	^{25,26} TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
$387 - i305$	^{26,27} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$420 - i370$	²⁸ ACHASOV	94	RVUE $\pi\pi \rightarrow \pi\pi$
$(506 \pm 10) - i(247 \pm 3)$	KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$370 - i356$	²⁹ ZOU	94B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

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408 – $i342$	26,29 ZOU 93	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
470 – $i208$	30 VANBEVEREN 86	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta,$
(750 ± 50) – $i(450 \pm 50)$	31 ESTABROOKS 79	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
(660 ± 100) – $i(320 \pm 70)$	PROTOPOPO... 73	HBC $\pi\pi \rightarrow \pi\pi, K\bar{K}$
650 – $i370$	32 BASDEVANT 72	RVUE $\pi\pi \rightarrow \pi\pi$
1 S-matrix pole; 8595 events.		
2 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 PROTOPOPOESCU 73.		
3 Uses the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPOESCU 73.		
4 Analytic continuation using Roy equations.		
5 Analytic continuation using GKPY equations.		
6 Using Roy equations.		
7 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.		
8 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.		
9 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of HYAMS 73.		
10 From the K_{e4} data of BATLEY 08A and $\pi N \rightarrow \pi\pi N$ data of PROTOPOPOESCU 73, GRAYER 74, and ESTABROOKS 74.		
11 From a mean of three different $f_0(500)$ parametrizations. Uses 40k events.		
12 From an isobar model using 2.6k events.		
13 Reanalysis of ABLIKIM 04A, PISLAK 01, and HYAMS 73 data.		
14 Using the N/D method.		
15 From the solution of the Roy equation (ROY 71) for the isoscalar S-wave and using a phase-shift analysis of HYAMS 73 and PROTOPOPOESCU 73 data.		
16 Reanalysis of the data from PROTOPOPOESCU 73, ESTABROOKS 74, GRAYER 74, ROSSELET 77, PISLAK 03, and AKHMETSHIN 04.		
17 From a mean of six different analyses and $f_0(500)$ parameterizations.		
18 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.		
19 From a combined analysis of HYAMS 73, AUGUSTIN 89, AITALA 01B, and PISLAK 01.		
20 A similar analysis (KOMADA 01) finds $(580^{+79}_{-30}) - i(190^{+107}_{-49})$ MeV.		
21 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.		
22 Using the inverse amplitude method and data of ESTABROOKS 73, GRAYER 74, and PROTOPOPOESCU 73.		
23 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.		
24 Average and spread of 4 variants ("up" and "down") of KAMINSKI 97B 3-channel model.		
25 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.		
26 Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.		
27 Analysis of data from FALVARD 88.		
28 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.		
29 Analysis of data from OCHS 73, GRAYER 74, and ROSSELET 77.		
30 Coupled-channel analysis using data from PROTOPOPOESCU 73, HYAMS 73, HYAMS 75, GRAYER 74, ESTABROOKS 74, ESTABROOKS 75, FROGGATT 77, CORDEN 79, BISWAS 81.		
31 Analysis of data from APEL 72C, GRAYER 74, CASON 76, PAWLICKI 77. Includes spread and errors of 4 solutions.		
32 Analysis of data from BATON 70, BENSINGER 71, COLTON 71, BAILLON 72, PROTOPOPOESCU 73, and WALKER 67.		

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$f_0(500)$ BREIT-WIGNER MASS OR K-MATRIX POLE PARAMETERS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(400–550) OUR ESTIMATE

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

513 ± 32	33 MURAMATSU 02	CLEO	$e^+e^- \approx 10$ GeV
478 ⁺²⁴ _{–23} ± 17	AITALA 01B	E791	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
563 ⁺⁵⁸ _{–29}	34 ISHIDA 01		$\Upsilon(3S) \rightarrow \Upsilon \pi \pi$
555	35 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 $\pi^- p_{\text{polar}} \rightarrow \pi^- \pi^+ n$
759 ± 5	36 TROYAN 98		5.2 $np \rightarrow np \pi^+ \pi^-$

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780±30	ALDE	97	GAM2	450 $pp \rightarrow pp\pi^0\pi^0$
585±20	37 ISHIDA	97		$\pi\pi \rightarrow \pi\pi$
761±12	38 SVEC	96	RVUE	6–17 $\pi N_{\text{polar}} \rightarrow \pi^+\pi^-N$
~ 860	39,40 TORNQVIST	96	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi, \eta\pi$
1165±50	41,42 ANISOVICH	95	RVUE	$\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
~ 1000	43 ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
414±20	38 AUGUSTIN	89	DM2	

33 Statistical uncertainty only.

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

35 From the best fit of the Dalitz plot.

36 6σ effect, no PWA.

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

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

39 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.

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

41 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.

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

43 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.

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$f_0(500)$ BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

(400–700) 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	$\pi^-p \rightarrow \pi^0\pi^0n,$ $\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\pi^0\eta, \pi^0\eta\eta$
~ 3200	54 ACHASOV	94	RVUE	$\pi\pi \rightarrow \pi\pi$
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.

54 Analysis of data from OCHS 73, ESTABROOKS 75, ROSSELET 77, and MUKHIN 80.

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$f_0(500)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\gamma\gamma$	seen

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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. • • •

2.05 ± 0.21	55 DAI	14A	RVUE	Compilation
1.7 ± 0.4	56 HOFERICHTER11		RVUE	Compilation
3.08 ± 0.82	57 MENNESSIER	11	RVUE	Compilation
2.08 ± 0.2 $^{+0.07}_{-0.04}$	58 MOUSSALLAM11		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	$e^+e^- \rightarrow \pi^+\pi^- e^+e^-$
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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 $f_0(500)$ REFERENCES

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)
HOFERICHTER	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>	
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
ABLIKIM	07A	PL B645 19	M. Ablikim <i>et al.</i>	(BES Collab.)
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
BUGG	07A	JP G34 151	D.V. Bugg <i>et al.</i>	
GARCIA-MAR...	07	PR D76 074034	R. Garcia-Martin, J.R. Pelaez, F.J. Yndurain	
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)

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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
BUETTIKER	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 (err.)	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 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	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
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
LOCHER	98	Translated from UFN 168 481	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
TROYAN	98	EPJ C4 317	Yu. Troyan <i>et al.</i>		REFID=46615
ALDE	97	JINRRC 5-91 33	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45392
DOBADO	97	PL B397 350	A. Dobado, J.R. Pelaez		REFID=53964
ISHIDA	97	PR D56 3057	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	(HELS)	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
CORDEN	79	Translated from ZETFP 32 616	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20374
ESTABROOKS	79	NP B157 250	P. Estabrooks	(CARL)	REFID=20375
FROGGATT	77	PR D19 2678	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
PAWLICKI	77	NP B129 89	A.J. Pawlicki <i>et al.</i>	(ANL) IJ	REFID=20367
ROSSELET	77	PR D15 3196	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
CASON	76	PR D15 574	N.M. Cason <i>et al.</i>	(NDAM, ANL) IJ	REFID=21064
ESTABROOKS	75	PRL 36 1485	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20642
HYAMS	75	NP B95 322	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
SRINIVASAN	75	NP B100 205	V. Srinivasan <i>et al.</i>	(NDAM, ANL)	REFID=21062
ESTABROOKS	74	PR D12 681	P.G. Estabrooks, A.D. Martin	(DURH)	REFID=20111
GRAYER	74	NP B79 301	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
ESTABROOKS	73	NP B75 189	P.G. Estabrooks <i>et al.</i>	(CERN, MPIM)	REFID=20345
HYAMS	73	Tallahassee	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
OCHS	73	NP B64 134	W. Ochs	(MPIM, MUNI)	REFID=20349
PROTOPOP...	73	Thesis	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108
PEL	72C	PR D7 1279	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=21013
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

NODE=M009

 $\rho(770)$

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

NODE=M009

THE $\rho(770)$

Updated September 2019 by S. Eidelman (Novosibirsk) and G. Venanzoni (Pisa).

The determination of the parameters of the $\rho(770)$ is beset with many difficulties because of its large width. In physical region fits, the line shape does not correspond to a relativistic Breit-Wigner function with a P -wave width, but requires some additional shape parameter. This dependence on parameterization was demonstrated long ago [1]. Bose-Einstein correlations are another source of shifts in the $\rho(770)$ line shape, particularly in multiparticle final-state systems [2].

The same model dependence afflicts any other source of resonance parameters, such as the energy dependence of the phase shift δ_1^1 , or the pole position. It is, therefore, not surprising that a study of $\rho(770)$ dominance in the decays of the η and η' reveals the need for specific dynamical effects, in addition to the $\rho(770)$ pole [3,4].

The cleanest determination of the $\rho(770)$ mass and width comes from e^+e^- annihilation and τ -lepton decays. Analysis of ALEPH [5] showed that the charged $\rho(770)$ parameters measured from τ -lepton decays are consistent with those of the neutral one determined from e^+e^- data [6]. This conclusion is qualitatively supported by the later studies of CLEO [7] and Belle [8]. However, comparison of the two-pion mass spectrum in τ decays from OPAL [9], CLEO [7], and ALEPH [10,11], and the $e^+e^- \rightarrow \pi^+\pi^-$ cross section from CMD-2 [12,13], showed significant discrepancies between the two shapes which can be as high as 10% above the ρ meson [14,15]. This discrepancy remains after measurements of the two-pion cross section in e^+e^- annihilation at KLOE [16,17,18,19], SND [20,21], BaBar [22] and, more recently BESIII [23]. The effect is not accounted for by isospin breaking [24,25,26,27], but the accuracy of its calculation may be overestimated [28,29].

This problem seems to be solved after a recent analysis in [30] which showed that after correcting the τ data for the missing $\rho-\gamma$ mixing contribution, besides the other known isospin symmetry violating corrections, the $\pi\pi$ $I=1$ part of the hadronic vacuum polarization contribution to the muon $g-2$ is fully compatible between τ based and e^+e^- based evaluations.

The global fit of the whole set of the ρ , ω , and ϕ decays, taking into account mixing effects in the hidden local symmetry model, also showed consistency of the data on τ decays to two pions and e^+e^- annihilation [31,32]. However, because of the progress in e^+e^- data, the τ input is now less precise and less reliable due to additional theoretical uncertainties [33] decreasing importance of τ versus e^+e^- comparison for the determination of $\rho(770)$ parameters and other applications, like, e.g., calculations of hadronic vacuum polarization.

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(761^{+4}_{-3}) - i(71.7^{+1.9}_{-2.3})$	1 GARCIA-MAR..11	RVUE	Compilation
$(763.7^{+1.7}_{-1.5}) - i(73.2^{+1.0}_{-1.1})$	2 GARCIA-MAR..11	RVUE	Compilation
$(754 \pm 18) - i(74 \pm 10)$	3 PELAEZ	04A 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 PROTOPODESCU 73 using Roy equations. ² Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPODESCU 73 using GKPY equations. ³ Reanalysis of data from PROTOPODESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.			

NODE=M009PP

NODE=M009PP

OCCUR=2

OCCUR=2

NODE=M009PP;LINKAGE=A

NODE=M009PP;LINKAGE=C

NODE=M009PP;LINKAGE=B

$\rho(770)$ MASS

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

NODE=M009205

NODE=M009205

NEUTRAL ONLY, e^+e^-

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
775.26 ± 0.25 OUR AVERAGE				
775.02 ± 0.35		1 LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
775.97 ± 0.46 ± 0.70	900k	2 AKHMETSHIN 07		$e^+e^- \rightarrow \pi^+\pi^-$
774.6 ± 0.4 ± 0.5	800k	3,4 ACHASOV	06	SND $e^+e^- \rightarrow \pi^+\pi^-$
775.65 ± 0.64 ± 0.50	114k	5,6 AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-$
775.9 ± 0.5 ± 0.5	1.98M	7 ALOISIO	03	KLOE $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.8 ± 0.9 ± 2.0	500k	7 ACHASOV	02	SND $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 ± 1.1		8 BARKOV	85	OLYA $e^+e^- \rightarrow \pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
763.49 ± 0.53		9 BARTOS	17	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
758.23 ± 0.46		10 BARTOS	17A	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
775.8 ± 0.5 ± 0.3	1.98M	11 ALOISIO	03	KLOE $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.9 ± 0.6 ± 0.5	1.98M	12 ALOISIO	03	KLOE $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.0 ± 0.6 ± 1.1	500k	13 ACHASOV	02	SND $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 ± 0.7 ± 5.3		14 BENAYOUN	98	RVUE $e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$
770.5 ± 1.9 ± 5.1		15 GARDNER	98	RVUE $0.28-0.92 e^+e^- \rightarrow \pi^+\pi^-$
764.1 ± 0.7		16 O'CONNELL	97	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
757.5 ± 1.5		17 BERNICHA	94	RVUE $e^+e^- \rightarrow \pi^+\pi^-$
768 ± 1		18 GESHKEN...	89	RVUE $e^+e^- \rightarrow \pi^+\pi^-$

NODE=M009M0
NODE=M009M0

OCCUR=2

OCCUR=3

OCCUR=3

- ¹ Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference and leaving the masses and widths of the $\rho(1450)$, $\rho(1700)$, and $\rho(2150)$ resonances as free parameters of the fit.
- ² A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.
- ³ Supersedes ACHASOV 05A.
- ⁴ 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.
- ⁵ Using the GOUNARIS 68 parametrization with the complex phase of the $\rho-\omega$ interference.
- ⁶ Update of AKHMETSHIN 02.
- ⁷ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.
- ⁸ From the GOUNARIS 68 parametrization of the pion form factor.
- ⁹ 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.
- ¹⁰ 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.
- ¹¹ Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.

NODE=M009M0;LINKAGE=LE

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

¹² Without limitations on masses and widths.

¹³ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.

¹⁴ Using the data of BARKOV 85 in the hidden local symmetry model.

¹⁵ 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.

¹⁶ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.

¹⁷ Applying the S-matrix formalism to the BARKOV 85 data.

¹⁸ Includes BARKOV 85 data. Model-dependent width definition.

NODE=M009M0;LINKAGE=WO

NODE=M009M0;LINKAGE=HC

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$\pm$0.34 OUR AVERAGE					
774.6 $\pm$ 0.2 $\pm$ 0.5	5.4M	^{1,2} FUJIKAWA	08	BELL $\pm$	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 $\pm$ 0.7		^{2,3} SCHAEAL	05c	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
775.5 $\pm$ 0.5 $\pm$ 0.4	1.98M	⁴ ALOISIO	03	KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 $\pm$ 1.1 $\pm$ 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 $\pm$ 0.95		⁷ BARTOS	17A	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.8 $\pm$ 0.6 $\pm$ 0.4	1.98M	⁸ ALOISIO	03	KLOE $-$	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
776.3 $\pm$ 0.6 $\pm$ 0.7	1.98M	⁸ ALOISIO	03	KLOE $+$	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
773.9 $\pm$ 2.0 $^{+0.3}_{-1.0}$		⁹ SANZ-CILLERO	03	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
774.5 $\pm$ 0.7 $\pm$ 1.5	500k	⁴ ACHASOV	02	SND $\pm$	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
775.1 $\pm$ 0.5		¹⁰ PICH	01	RVUE	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

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.

NODE=M009M5

NODE=M009M5

OCCUR=2

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$\pm$0.3$\pm$1.2	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=M009M7

NODE=M009M7

NODE=M009M7;LINKAGE=LB

CHARGED ONLY, HADROPRODUCED

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

NODE=M009M2

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
769.0 ± 1.0 OUR AVERAGE				
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.

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	$16 \pi^+ p$
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	$2.26 \pi^- p$
769.2 ± 1.5	13.3k	⁶ PISUT 68	RVUE	$1.7\text{--}3.2 \pi^- p, t < 10$

• • • 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	$17 \pi^- p$ 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	$2.8 \pi^- p$
775 ± 3	2.2k	¹⁵ HYAMS 68	OSPK	$11.2 \pi^- p$

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, GOLDHABER 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.

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=M009M0P
NODE=M009M0P

OCCUR=2

OCCUR=2

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

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

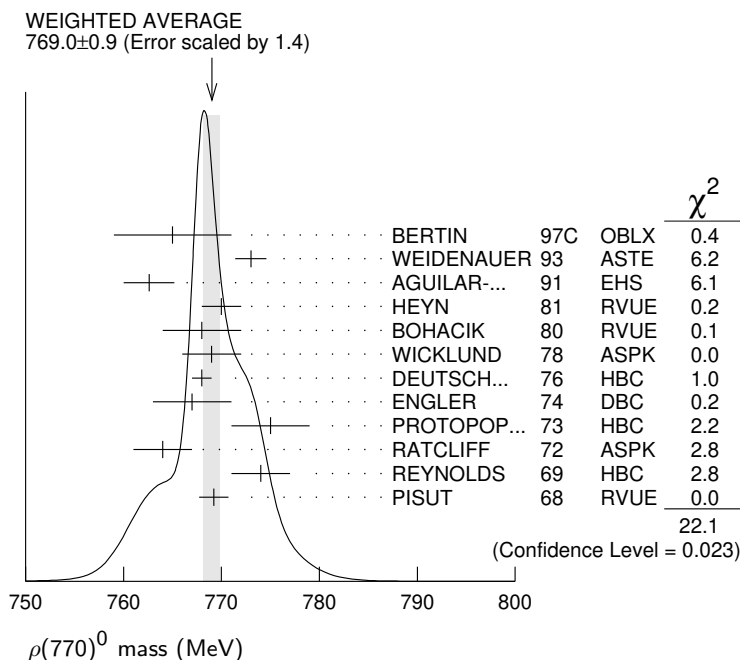
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NODE=M009M0R;LINKAGE=A1
NODE=M009M0R;LINKAGE=QQ
NODE=M009M0R;LINKAGE=G

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 ±0.8 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
-2.4 ±0.8		1 SCHAEEL	05C	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
0.4 ±0.7 ±0.6 1.98M		2 ALOISIO	03	KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.3 ±1.1 ±2.0 500k		2 ACHASOV	02	SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1.6 ±0.6 ±1.7 600k		ABELE	99E	CBAR ±0	$0.0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
-4 ±4 3000		3 REYNOLDS	69	HBC	-0 2.26 $\pi^- p$
-5 ±5 3600		3 FOSTER	68	HBC	±0 0.0 $\bar{p} p$
2.4 ±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 ±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 SCHAEEL 05C and $e^+ e^-$ data from the compilation of BARKOV 85, AKHMETSHIN 04, and ALOISIO 05. Supersedes BARATE 97M.

NODE=M009D;LINKAGE=SC

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

NODE=M009D;LINKAGE=CH

³ From quoted masses of charged and neutral modes.

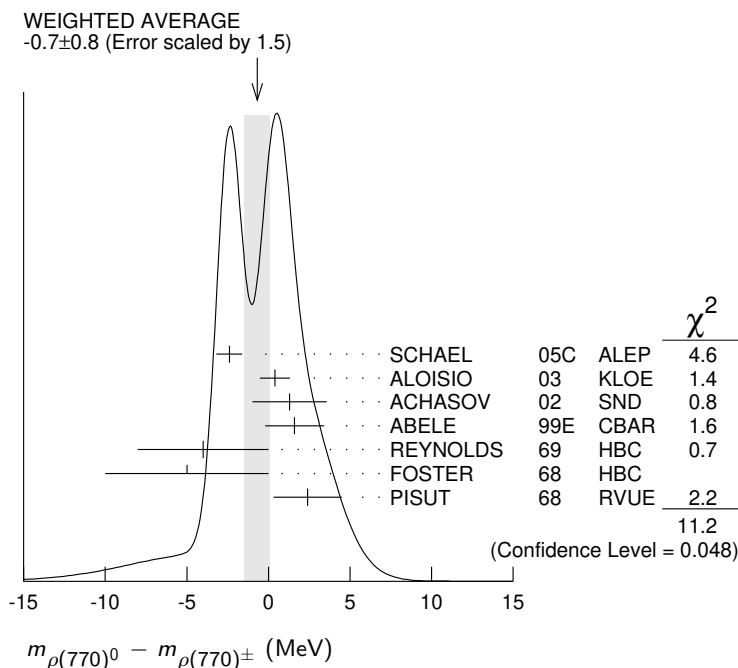
NODE=M009D;LINKAGE=A

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.

NODE=M009D;LINKAGE=R

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=B



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

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=M009D1

NODE=M009D;LINKAGE=WO

$\rho(770)$ RANGE PARAMETER

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, $q = q_r$.

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

NODE=M009R

NODE=M009R;LINKAGE=01

$\rho(770)$ WIDTH

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

NODE=M009220

NODE=M009220

NEUTRAL ONLY, $e^+ e^-$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
147.8 ± 0.9 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below.		
149.59 ± 0.67		¹ LEES	12G BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$145.98 \pm 0.75 \pm 0.50$	900k	² AKHMETSHIN	07	$e^+ e^- \rightarrow \pi^+ \pi^-$
$146.1 \pm 0.8 \pm 1.5$	800k	^{3,4} ACHASOV	06 SND	$e^+ e^- \rightarrow \pi^+ \pi^-$
$143.85 \pm 1.33 \pm 0.80$	114k	^{5,6} AKHMETSHIN	04 CMD2	$e^+ e^- \rightarrow \pi^+ \pi^-$
$147.3 \pm 1.5 \pm 0.7$	1.98M	⁷ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$151.1 \pm 2.6 \pm 3.0$	500k	⁷ ACHASOV	02 SND	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
150.5 ± 3.0		⁸ BARKOV	85 OLYA	$e^+ e^- \rightarrow \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
144.06 ± 0.85		⁹ BARTOS	17 RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
144.56 ± 0.80		¹⁰ BARTOS	17A RVUE	$e^+ e^- \rightarrow \pi^+ \pi^-$
$143.9 \pm 1.3 \pm 1.1$	1.98M	¹¹ ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
$147.4 \pm 1.5 \pm 0.7$	1.98M	¹² ALOISIO	03 KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M009W0
NODE=M009W0

OCCUR=2

OCCUR=3

149.8 ±2.2 ±2.0	500k	13	ACHASOV	02	SND	1.02 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
147.9 ±1.5 ±7.5		14	BENAYOUN	98	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$, $\mu^+\mu^-$
153.5 ±1.3 ±4.6		15	GARDNER	98	RVUE	0.28–0.92 $e^+e^- \rightarrow \pi^+\pi^-$
145.0 ±1.7		16	O'CONNELL	97	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
142.5 ±3.5		17	BERNICA	94	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$
138 ±1		18	GESHKEN...	89	RVUE	$e^+e^- \rightarrow \pi^+\pi^-$

OCCUR=3

¹ 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.

² A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.

³ Supersedes ACHASOV 05A.

⁴ 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.

⁵ Using the GOUNARIS 68 parametrization with the complex phase of the ρ - ω interference.

⁶ From a fit in the energy range 0.61 to 0.96 GeV. Update of AKHMETSHIN 02.

⁷ Assuming $m_{\rho^+} = m_{\rho^-}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-}$.

⁸ From the GOUNARIS 68 parametrization of the pion form factor.

⁹ Applies the Unitary & Analytic Model of the pion electromagnetic form factor of DUBNICKA 10 to analyze the data of LEES 12G and ABLIKIM 16C.

¹⁰ 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.

¹¹ Assuming $m_{\rho^+} = m_{\rho^-} = m_{\rho^0}$, $\Gamma_{\rho^+} = \Gamma_{\rho^-} = \Gamma_{\rho^0}$.

¹² Without limitations on masses and widths.

¹³ Assuming $m_{\rho^0} = m_{\rho^\pm}$, $g_{\rho^0\pi\pi} = g_{\rho^\pm\pi\pi}$.

¹⁴ Using the data of BARKOV 85 in the hidden local symmetry model.

¹⁵ 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.

¹⁶ A fit of BARKOV 85 data assuming the direct $\omega\pi\pi$ coupling.

¹⁷ Applying the S-matrix formalism to the BARKOV 85 data.

¹⁸ Includes BARKOV 85 data. Model-dependent width definition.

NODE=M009W0;LINKAGE=LE

NODE=M009W;LINKAGE=AK

NODE=M009W0;LINKAGE=AC

NODE=M009W0;LINKAGE=SN

NODE=M009W5;LINKAGE=GS

NODE=M009W5;LINKAGE=P2

NODE=M009W;LINKAGE=CH

NODE=M009W;LINKAGE=K

NODE=M009W0;LINKAGE=A

NODE=M009W0;LINKAGE=B

NODE=M009W;LINKAGE=DF

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NODE=M009W;LINKAGE=HC

NODE=M009W;LINKAGE=K2

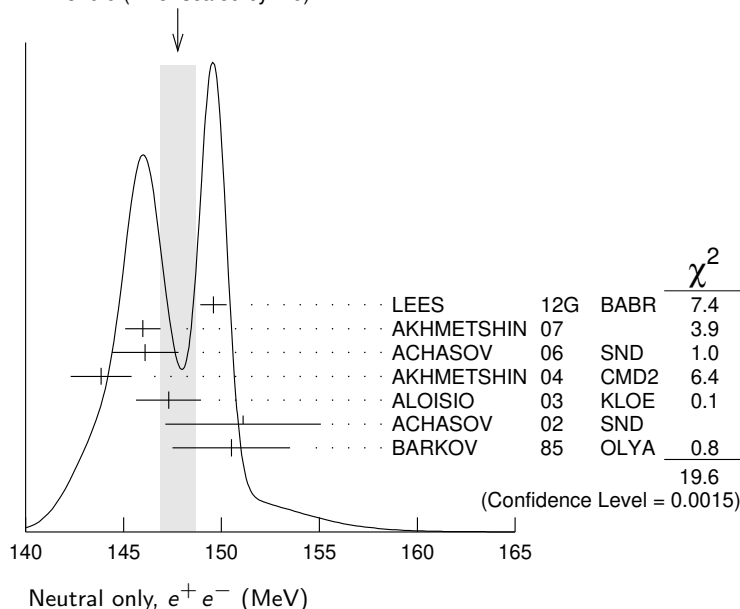
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NODE=M009W;LINKAGE=AB

NODE=M009W;LINKAGE=AA

NODE=M009W;LINKAGE=F

WEIGHTED AVERAGE
147.8±0.9 (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	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.0 ±1.2		2,3 SCHAEAL	05c	ALEP	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$
149.9 ±2.3 ±2.0	500k	4 ACHASOV	02	SND	$1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
150.4 ±1.4 ±1.4	87k	5,6 ANDERSON	00A	CLE2	$\tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

NODE=M009W5
NODE=M009W5

OCCUR=2

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

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

NODE=M009W7
NODE=M009W7

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=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 −	$1.7\text{--}3.2 \pi^- p, t < 10$
146 ±13	900	EISNER	67	HBC −	$4.2 \pi^- p, t < 10$

OCCUR=2

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

NODE=M009W2;LINKAGE=A

NEUTRAL ONLY, PHOTOPRODUCED

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
151.7± 2.6 OUR AVERAGE				

155 ± 5 ± 2	63.5k	¹ ABRAMOWICZ	12	ZEUS	$e p \rightarrow e \pi^+ \pi^- p$
146 ± 3 ± 13	79k	² BREITWEG	98B	ZEUS	$50\text{--}100 \gamma p$
150.9± 3.0		BARTALUCCI	78	CNTR	$\gamma p \rightarrow e^+ e^- p$

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

138 ± 3	79k	³ BREITWEG	98B	ZEUS	$50\text{--}100 \gamma p$
147 ±11		GLADDING	73	CNTR	$2.9\text{--}4.7 \gamma p$
155 ±12	2430	BALLAM	72	HBC	$4.7 \gamma p$
145 ±13	1930	BALLAM	72	HBC	$2.8 \gamma p$
140 ± 5		ALVENSLEB...	70	CNTR	$\gamma A, t < 0.01$
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	$\gamma + \text{Pb}$

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 $3,4,6 \pi^\pm pN$
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 $470 \mu p \rightarrow \mu XB$
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 $1.7-3.2 \pi^- p, t < 10$

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. MR¹² 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=M009W0R
NODE=M009W0R

OCCUR=2

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=GNODE=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 $1.02 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.66 ± 0.85		³ BARTOS	17A	RVUE $e^+e^- \rightarrow \pi^+\pi^-, \tau^- \rightarrow \pi^-\pi^0\nu_\tau$

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 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=M009W6
NODE=M009W6

NODE=M009W6;LINKAGE=SC

NODE=M009W6;LINKAGE=CH
NODE=M009W6;LINKAGE=A **$\Gamma_{\rho(770)^+} - \Gamma_{\rho(770)^-}$**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.8 ± 2.0 ± 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=M009W16
NODE=M009W16

NODE=M009W16;LINKAGE=WO

$\rho(770)$ DECAY MODES

NODE=M009225;NODE=M009

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$\pi\pi$	~ 100	%
Γ_2	$K\bar{K}$		
$\rho(770)^\pm$ decays			
Γ_3	$\pi^\pm\pi^0$	~ 100	%
Γ_4	$\pi^\pm\gamma$	$(4.5 \pm 0.5) \times 10^{-4}$	S=2.2
Γ_5	$\pi^\pm\eta$	< 6	$\times 10^{-3}$ CL=84%
Γ_6	$\pi^\pm\pi^+\pi^-\pi^0$	< 2.0	$\times 10^{-3}$ CL=84%
$\rho(770)^0$ decays			
Γ_7	$\pi^+\pi^-$	~ 100	%
Γ_8	$\pi^+\pi^-\gamma$	$(9.9 \pm 1.6) \times 10^{-3}$	
Γ_9	$\pi^0\gamma$	$(4.7 \pm 0.6) \times 10^{-4}$	S=1.4
Γ_{10}	$\eta\gamma$	$(3.00 \pm 0.21) \times 10^{-4}$	
Γ_{11}	$\pi^0\pi^0\gamma$	$(4.5 \pm 0.8) \times 10^{-5}$	
Γ_{12}	$\mu^+\mu^-$	[a] $(4.55 \pm 0.28) \times 10^{-5}$	
Γ_{13}	e^+e^-	[a] $(4.72 \pm 0.05) \times 10^{-5}$	
Γ_{14}	$\pi^+\pi^-\pi^0$	$(1.01^{+0.54}_{-0.36} \pm 0.34) \times 10^{-4}$	
Γ_{15}	$\pi^+\pi^-\pi^+\pi^-$	$(1.8 \pm 0.9) \times 10^{-5}$	
Γ_{16}	$\pi^+\pi^-\pi^0\pi^0$	$(1.6 \pm 0.8) \times 10^{-5}$	
Γ_{17}	$\pi^0e^+e^-$	< 1.2	$\times 10^{-5}$ CL=90%
Γ_{18}	ηe^+e^-		

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=81NODE=M009;CLUMP=A
DESIG=11;OUR EVAL;→ UNCHECKED ←
DESIG=3
DESIG=5
DESIG=21NODE=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_4	$\left \begin{array}{cc} -100 & \\ 15 & -15 \end{array} \right $
Γ	$\begin{array}{cc} & x_3 \quad x_4 \end{array}$

	Mode	Rate (MeV)	Scale factor
Γ_3	$\pi^\pm\pi^0$	150.2 ± 2.4	
Γ_4	$\pi^\pm\gamma$	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 22 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 9.5$ for 14 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_8	-100								
x_9	-4	0							
x_{10}	-1	0	1						
x_{11}	-1	0	0	0					
x_{12}	2	-3	0	0	0				
x_{13}	0	0	-8	-9	0	0			
x_{15}	-1	0	0	0	0	0	0		
Γ	0	0	4	5	0	0	-54	0	
	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{15}	

	Mode	Rate (MeV)	Scale factor
Γ_7	$\pi^+ \pi^-$	147.5 $\pm$ 0.9	
Γ_8	$\pi^+ \pi^- \gamma$	1.48 $\pm$ 0.24	
Γ_9	$\pi^0 \gamma$	0.070 $\pm$ 0.009	1.4
Γ_{10}	$\eta \gamma$	0.0447 $\pm$ 0.0032	
Γ_{11}	$\pi^0 \pi^0 \gamma$	0.0066 $\pm$ 0.0012	
Γ_{12}	$\mu^+ \mu^-$	[a] 0.0068 $\pm$ 0.0004	
Γ_{13}	$e^+ e^-$	[a] 0.00704 $\pm$ 0.00006	
Γ_{15}	$\pi^+ \pi^- \pi^+ \pi^-$	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

$\Gamma(\pi^\pm \gamma)$

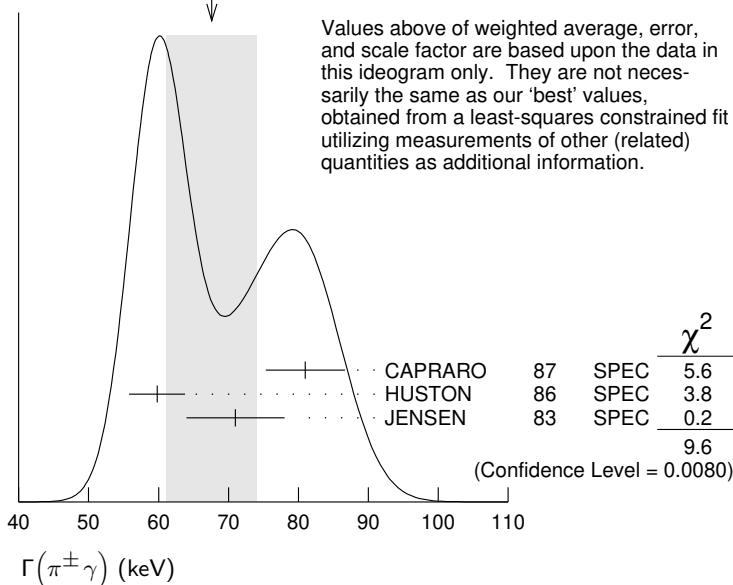
 Γ_4

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 π^- A $\rightarrow$ $\pi^- \pi^0$ A
59.8 $\pm$ 4.0	HUSTON	86	SPEC	+ 202 π^+ A $\rightarrow$ $\pi^+ \pi^0$ A
71 $\pm$ 7	JENSEN	83	SPEC	- 156-260 π^- 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_9

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_{10}

VALUE (keV)	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_{13}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	$e^+e^- \rightarrow \pi^+\pi^-, \mu^+\mu^-$

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_{15}

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

 $\Gamma(e^+e^-) / \Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-) / \Gamma_{\text{total}}$ $\Gamma_{13} / \Gamma \times \Gamma_7 / \Gamma$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.876 $\pm$ 0.023 $\pm$ 0.064	800k	^{1,2} ACHASOV	06 SND	$e^+e^- \rightarrow \pi^+\pi^-$
4.72 ± 0.02		³ BENAYOUN	10 RVUE	$0.4-1.05 e^+e^-$

NODE=M009G4
 NODE=M009G4

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

NODE=M009G4;LINKAGE=BE

 $\Gamma(e^+e^-) / \Gamma_{\text{total}} \times \Gamma(\eta\gamma) / \Gamma_{\text{total}}$ $\Gamma_{13} / \Gamma \times \Gamma_{10} / \Gamma$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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

NODE=M009G1;LINKAGE=AH

NODE=M009G;LINKAGE=AH
 NODE=M009G;LINKAGE=AK
 NODE=M009G;LINKAGE=BQ

NODE=M009G;LINKAGE=LP
 NODE=M009G1;LINKAGE=BE

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.

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

$$\Gamma_{13}/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-8})	EVTS	DOCUMENT ID	TECN	COMMENT
2.22 ± 0.29 OUR FIT				Error includes scale factor of 1.4.
2.22 ± 0.26 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
1.98 ± 0.22 ± 0.10		¹ ACHASOV 16A	SND	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
2.90 $^{+0.60}_{-0.55}$ ± 0.18	18k	AKHMETSHIN 05	CMD2	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
2.37 ± 0.53 ± 0.33	36k	² ACHASOV 03	SND	0.60-0.97 $e^+e^- \rightarrow \pi^0\gamma$
3.61 ± 0.74 ± 0.49	10k	³ 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 ⁴ BENAYOUN 10 RVUE 0.4-1.05 e^+e^-

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 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 $(-10.2 \pm 7.0)^\circ$.

³ Recalculated by us from the cross section in the peak.

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

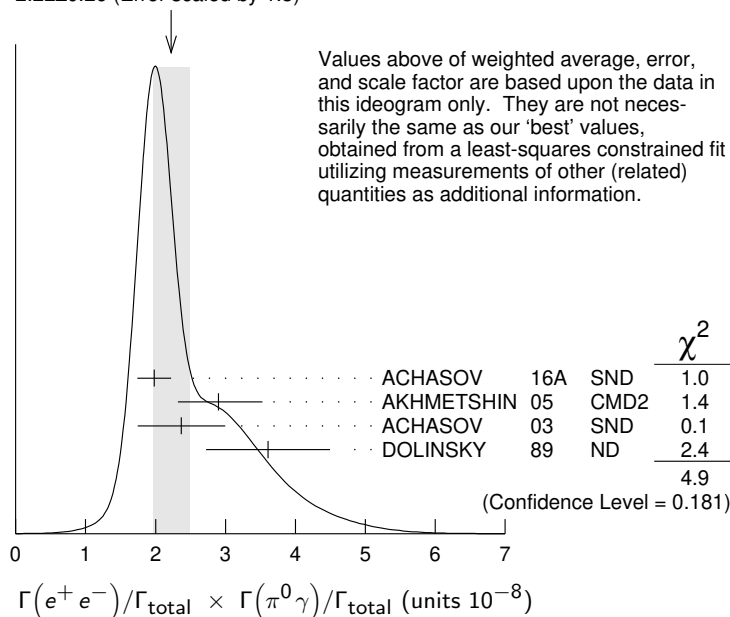
NODE=M009G2
NODE=M009G2

NODE=M009G2;LINKAGE=B

NODE=M009G;LINKAGE=SH

NODE=M009G2;LINKAGE=LP
NODE=M009G2;LINKAGE=BE

WEIGHTED AVERAGE
2.22±0.26 (Error scaled by 1.3)



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

$$\Gamma_{13}/\Gamma \times \Gamma_{14}/\Gamma$$

VALUE (units 10^{-9})	EVTS	DOCUMENT ID	TECN	COMMENT
0.903 ± 0.076		¹ BENAYOUN 10	RVUE	0.4-1.05 e^+e^-
4.58 $^{+2.46}_{-1.64}$ ± 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

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

$$\Gamma_5/\Gamma_1$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<60	84	FERBEL 66	HBC	±	$\pi^\pm p$ above 2.5

NODE=M009R4
NODE=M009R4

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

$$\Gamma_6/\Gamma_1$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<20	84	FERBEL 66	HBC	±	$\pi^\pm p$ above 2.5

NODE=M009R1
NODE=M009R1

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

35 ± 40 JAMES 66 HBC + 2.1 $\pi^+ p$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.0099±0.0016 OUR FIT				
0.0099±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	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
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.				

 NODE=M009R12
 NODE=M009R12

OCCUR=2

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

 $\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$
 Γ_9/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
 NODE=M009R9

 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_{10}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
3.00±0.21 OUR FIT					
2.90±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 γCu
• • • 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=M009R7;LINKAGE=AK
 NODE=M009R7;LINKAGE=AZ
 NODE=M009R7;LINKAGE=BQ

NODE=M009R7;LINKAGE=BX

NODE=M009R7;LINKAGE=C

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
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 $e^+e^- \rightarrow \pi^0\pi^0\gamma$
$4.1^{+1.0}_{-0.9} \pm 0.3$	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	$e^+e^- \rightarrow \pi^0\pi^0\gamma$

 NODE=M009R14
 NODE=M009R14

OCCUR=2

- 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.
- 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.
- ³ Superseded by ACHASOV 02F.

NODE=M009R14;LINKAGE=AH

NODE=M009R;LINKAGE=FF

NODE=M009R;LINKAGE=GF

 $\Gamma(\mu^+ \mu^-)/\Gamma(\pi^+ \pi^-)$ Γ_{12}/Γ_7 VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

4.60±0.28 OUR FIT**4.6 ±0.2 ±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

Photoproduction

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

NODE=M009R5;LINKAGE=R

NODE=M009R5;LINKAGE=W

NODE=M009R5;LINKAGE=01

NODE=M009R5;LINKAGE=H

 $\Gamma(e^+ e^-)/\Gamma(\pi \pi)$ Γ_{13}/Γ_1 VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

• • • 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.² Barkov excludes Auslander and Benaksas for large statistical and systematic errors.

NODE=M009R;LINKAGE=KS

NODE=M009R3;LINKAGE=01

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{14}/Γ VALUE (units 10^{-4})

CL% EVTS

DOCUMENT ID

TECN

COMMENT

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

1.01 $^{+0.54}_{-0.36} \pm 0.34$

1.2M

¹ 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 Statistical significance is less than 3σ .

NODE=M009R;LINKAGE=NS

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma(\pi \pi)$ Γ_{14}/Γ_1

VALUE

CL%

DOCUMENT ID

TECN

CHG

COMMENT

• • • 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

 $3.7 \pi^+ p$ ¹ Model dependent, assumes $l = 1, 2$, or 3 for the 3π system.

NODE=M009R6

NODE=M009R6

NODE=M009R6;LINKAGE=G

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

CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.8±0.9 OUR FIT**1.8±0.9±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_{15}/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

 $2.5-5.8 \gamma p$

<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_{16}/Γ
VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	
$1.60\pm0.74\pm0.18$		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	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\pi^0$
¹ Assuming no interference between the ρ and ω contributions.					

NODE=M009R8
NODE=M009R8

NODE=M009R8;LINKAGE=AC

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$					Γ_{17}/Γ
<i>VALUE</i> (units 10^{-5})	<i>CL%</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
<1.2	90	ACHASOV	08	SND	$0.36\text{--}0.97\ e^+e^- \rightarrow \pi^0 e^+e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.6		AKHMETSHIN	05A	CMD2	$0.72\text{--}0.84\ e^+e^-$

NODE=M009R15
NODE=M009R15

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$	Γ_{18}/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

NODE=M009

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
Translated from ZETF 136 442.					
AUBERT	09AS	PRL 103 231801	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53136
ACHASOV	08	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	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
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.					
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
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	00	PL B475 190	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47421
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
ABELE	99E	PL B469 270	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47414
BENAYOUN	98	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADLD+)	REFID=45859
BREITWEG	98B	EPJ C2 247	J. Breitweg <i>et al.</i>	(ZEUS Collab.)	REFID=46354
GARDNER	98	PR D57 2716	S. Gardner, H.B. O'Connell		REFID=46366
Also PR D62 019903 (errat.)					REFID=47981
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ADAMS	97	ZPHY C74 237	M.R. Adams <i>et al.</i>	(E665 Collab.)	REFID=45533
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
BOGOLYUB...	97	PAN 60 46	M.Y. Bogolyubsky <i>et al.</i>	(MOSU, SERP)	REFID=45393
Translated from YAF 60 53.					

O'CONNELL	97	NP A623 559	H.B. O'Connell <i>et al.</i>	(ADLD)	REFID=45860
BENAYOUN	96	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
BERNICA	94	PR D50 4454	A. Bernica, G. Lopez Castro, J. Pestieau	(LOUV+)	REFID=44097
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
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
ANTIPOV	89	ZPHY C42 185	Y.M. Antipov <i>et al.</i>	(SERP, JINR, BGNA+)	REFID=40739
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DOLINSKY	89	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
KURDADZE	88	JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
VASSERMAN	88	Translated from ZETFP 47 432. SJNP 47 1035	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41019
VASSERMAN	88B	Translated from YAF 47 1635. SJNP 48 480	I.B. Vasserman <i>et al.</i>	(NOVO)	REFID=41020
AULCHENKO	87C	Translated from YAF 48 753. IYF 87-90 Preprint	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=41370
CAPRARO	87	NP B288 659	L. Capraro <i>et al.</i>	(CLER, FRAS, MILA+)	REFID=40003
BRAMON	86	PL B173 97	A. Bramon, J. Casulleras	(BARC)	REFID=22102
HUSTON	86	PR D33 3199	J. Huston <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20137
KURDADZE	86	JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
DRUZHININ	84	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20131
JENSEN	83	PR D27 26	T. Jensen <i>et al.</i>	(ROCH, FNAL, MINN)	REFID=20132
HEYN	81	ZPHY C7 169	M.F. Heyn, C.B. Lang	(GRAZ)	REFID=20129
BOHACIK	80	PR D21 1342	J. Bohacik, H. Kuhnelt	(SLOW, WIEN)	REFID=20128
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL)	REFID=20381
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parada	(GRAZ)	REFID=20126
BARTALUCCI	78	NC 44A 587	S. Bartalucci <i>et al.</i>	(DESY, FRAS)	REFID=20122
WICKLUND	78	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
ANDREWS	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
DEUTSCH...	76	NP B103 426	M. Deutschmann <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20119
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)	REFID=20110
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
RATCLIFF	74	Private Comm.			REFID=40128; ERROR=3
BYERLY	73	PR D7 637	W.L. Byerly <i>et al.</i>	(MICH)	REFID=20104
GLADDING	73	PR D8 3721	G.E. Gladding <i>et al.</i>	(HARV)	REFID=20106
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopescu <i>et al.</i>	(LBL)	REFID=20108
BALLAM	72	PR D5 545	J. Ballam <i>et al.</i>	(SLAC, LBL, TUFTS)	REFID=20094
BENAKSAS	72	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
JACOBS	72	PR D6 1291	L.D. Jacobs	(SACL)	REFID=20101
RATCLIFF	72	PL 38B 345	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
ABRAMS	71	PR D4 653	G.S. Abrams <i>et al.</i>	(LBL)	REFID=20090
ALVENSLEB...	70	PRL 24 786	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20085
BIGGS	70	PRL 24 1197	P.J. Biggs <i>et al.</i>	(DARE)	REFID=20087
ERBE	69	PR 188 2060	R. Erbe <i>et al.</i>	(German Bubble Chamber Collab.)	REFID=20074
MALAMUD	69	Argonne Conf. 93	E.I. Malamud, P.E. Schlein	(UCLA)	REFID=20077
REYNOLDS	69	PR 184 1424	B.G. Reynolds <i>et al.</i>	(FSU)	REFID=20080
ROTHWELL	69	PRL 23 1521	P.L. Rothwell <i>et al.</i>	(NEAS)	REFID=20082
WEHMANN	69	PR 178 2095	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)	REFID=20084
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)	REFID=20054
BATON	68	PR 176 1574	J.P. Baton, G. Laurens	(SACL)	REFID=20056
CHUNG	68	PR 165 1491	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
FOSTER	68	NP B6 107	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=20061
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054
HUSON	68	PL 28B 208	R. Huson <i>et al.</i>	(ORSAY, MILA, UCLA)	REFID=20062
HYAMS	68	NP B7 1	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20063
LANZEROTTI	68	PR 166 1365	L.J. Lanzerotti <i>et al.</i>	(HARV)	REFID=20068
PISUT	68	NP B6 325	J. Pisut, M. Roos	(CERN)	REFID=20070
ASBURY	67B	PRL 19 865	J.G. Asbury <i>et al.</i>	(DESY, COLU)	REFID=20038
BACON	67	PR 157 1263	T.C. Bacon <i>et al.</i>	(BNL)	REFID=20039
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)	REFID=20046
HUWE	67	PL 24B 252	D.O. Huwe <i>et al.</i>	(COLU)	REFID=20049
HYAMS	67	PL 24B 634	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20050
MILLER	67B	PR 153 1423	D.H. Miller <i>et al.</i>	(PURD)	REFID=20051
ALFF-...	66	PR 145 1072	C. Alff-Steinberger <i>et al.</i>	(COLU, RUTG)	REFID=10762
FERBEL	66	PL 21 111	T. Ferbel	(ROCH)	REFID=20028
HAGOPIAN	66	PR 145 1128	V. Hagopian <i>et al.</i>	(PENN, SACL)	REFID=20030
HAGOPIAN	66B	PR 152 1183	V. Hagopian, Y.L. Pan	(PENN, LRL)	REFID=20031
JACOBS	66B	UCRL 16877	L.D. Jacobs	(LRL)	REFID=20033
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)	REFID=10770
ROSS	66	PR 149 1172	M. Ross, L. Stodolsky		REFID=46380
SOEDING	66	PL B19 702	P. Soeding		REFID=46385
WEST	66	PR 149 1089	E. West <i>et al.</i>	(WISC)	REFID=20035
BLIEDEN	65	PL 19 444	H.R. Blieden <i>et al.</i>	(CERN MMS Collab.)	REFID=20016
CARMONY	64	PRL 12 254	D.D. Carmony <i>et al.</i>	(UCB)	REFID=20578
GOLDHABER	64	PRL 12 336	G. Goldhaber <i>et al.</i>	(LRL, UCB)	REFID=20013
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)	REFID=20006

$\omega(782)$

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

NODE=M001

 $\omega(782)$ MASS

NODE=M001M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
782.65±0.12 OUR AVERAGE		Error includes scale factor of 1.9. See the ideogram below.		
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 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
782.7 ±0.1 ±1.5	19500	WURZINGER 95	SPEC	1.33 $p d \rightarrow {}^3\text{He} \omega$
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	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-\pi^0$
782.2 ±0.4	1488	KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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. ● ● ●				
781.91±0.24		⁶ LEES	12G	BABR $e^+e^- \rightarrow \pi^+\pi^-\gamma$
781.78±0.10		⁷ BARKOV	87	CMD $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
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	⁸ 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		⁹ 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 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.⁷ Systematic uncertainties underestimated.⁸ From best-resolution sample of COYNE 71.⁹ From $\omega-\rho$ interference in the $\pi^+\pi^-$ mass spectrum assuming ω width 12.6 MeV.

NODE=M001M;LINKAGE=PT

NODE=M001M;LINKAGE=VH

NODE=M001M;LINKAGE=S1

NODE=M001M;LINKAGE=S2

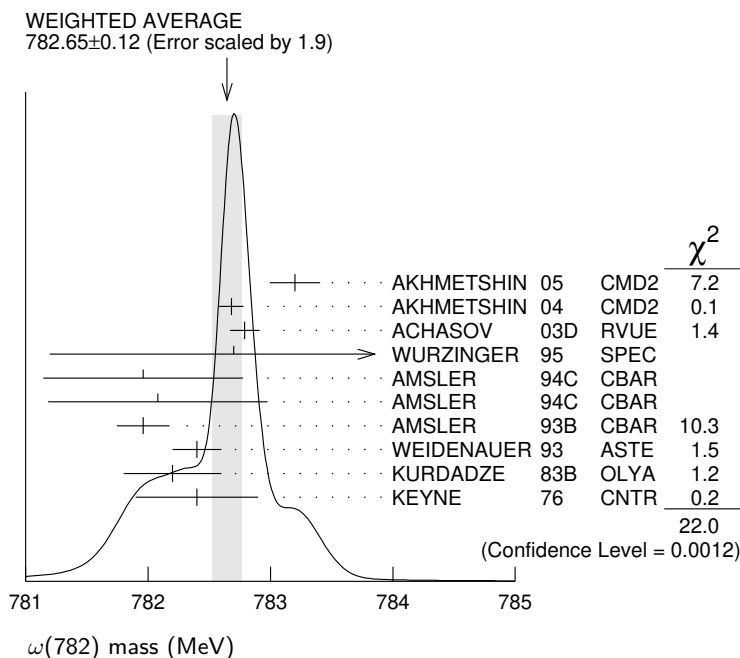
NODE=M001M;LINKAGE=B

NODE=M001M;LINKAGE=LE

NODE=M001M;LINKAGE=KB

NODE=M001M;LINKAGE=D

NODE=M001M;LINKAGE=F



$\omega(782)$ WIDTH

NODE=M001W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
8.49±0.08 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 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.2 ±0.3	19500	WURZINGER 95	SPEC	1.33 $pd \rightarrow {}^3\text{He}\omega$
8.4 ±0.1		3 AULCHENKO 87	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
8.30±0.40		BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.8 ±0.9	1488	KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.0 ±0.8	433	CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
9.1 ±0.8	451	BENAKSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
8.13±0.45		4 LEES 12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
12 ±2	1430	COOPER 78B	HBC	0.7–0.8 $p\bar{p} \rightarrow 5\pi$
9.4 ±2.5	2100	GESSAROLI 77	HBC	11 $\pi^-p \rightarrow \omega n$
10.22±0.43	20000	5 KEYNE 76	CNTR	$\pi^-p \rightarrow \omega n$
13.3 ±2	418	AGUILAR-... 72B	HBC	3.9,4.6 K^-p
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 $p\bar{p} \rightarrow K_1^0 K_1^0 \omega$
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 $\pi^+p \rightarrow p\pi^+\pi^+\pi^-\pi^0$

NODE=M001W

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 Relativistic Breit-Wigner includes radiative corrections.

⁴ 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.

⁵ Observed by threshold-crossing technique. Mass resolution = 4.8 MeV FWHM.

NODE=M001W;LINKAGE=PT
NODE=M001W;LINKAGE=VH

NODE=M001W;LINKAGE=D
NODE=M001W;LINKAGE=LE

NODE=M001W;LINKAGE=B

$\omega(782)$ DECAY MODES

NODE=M001215;NODE=M001

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 $\pi^+\pi^-\pi^0$	(89.3 ±0.6) %	
Γ_2 $\pi^0\gamma$	(8.40±0.22) %	S=1.8
Γ_3 $\pi^+\pi^-$	(1.53±0.06) %	
Γ_4 neutrals (excluding $\pi^0\gamma$)	(7 $\frac{+7}{-4}$) × 10 ⁻³	S=1.1
Γ_5 $\eta\gamma$	(4.5 ±0.4) × 10 ⁻⁴	S=1.1

DESIG=1

DESIG=3

DESIG=2

DESIG=13

DESIG=6

Γ_6	$\pi^0 e^+ e^-$	$(7.7 \pm 0.6) \times 10^{-4}$		DESIG=14
Γ_7	$\pi^0 \mu^+ \mu^-$	$(1.34 \pm 0.18) \times 10^{-4}$	S=1.5	DESIG=11
Γ_8	$\eta e^+ e^-$			DESIG=18
Γ_9	$e^+ e^-$	$(7.36 \pm 0.15) \times 10^{-5}$	S=1.5	DESIG=7
Γ_{10}	$\pi^+ \pi^- \pi^0 \pi^0$	$< 2 \times 10^{-4}$	CL=90%	DESIG=12
Γ_{11}	$\pi^+ \pi^- \gamma$	$< 3.6 \times 10^{-3}$	CL=95%	DESIG=4
Γ_{12}	$\pi^+ \pi^- \pi^+ \pi^-$	$< 1 \times 10^{-3}$	CL=90%	DESIG=15
Γ_{13}	$\pi^0 \pi^0 \gamma$	$(6.7 \pm 1.1) \times 10^{-5}$		DESIG=5
Γ_{14}	$\eta \pi^0 \gamma$	$< 3.3 \times 10^{-5}$	CL=90%	DESIG=17
Γ_{15}	$\mu^+ \mu^-$	$(7.4 \pm 1.8) \times 10^{-5}$		DESIG=8
Γ_{16}	3γ	$< 1.9 \times 10^{-4}$	CL=95%	DESIG=10

Charge conjugation (C) violating modes

Γ_{17}	$\eta \pi^0$	C	$< 2.2 \times 10^{-4}$	CL=90%	NODE=M001;CLUMP=A DESIG=9
Γ_{18}	$2\pi^0$	C	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=193
Γ_{19}	$3\pi^0$	C	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=16
Γ_{20}	invisible		$< 7 \times 10^{-5}$	CL=90%	DESIG=194

CONSTRAINED FIT INFORMATION

An overall fit to 15 branching ratios uses 55 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 57.0$ for 46 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	28								
x_3	-9	-3							
x_4	-95	-55	0						
x_5	7	15	-1	-12					
x_6	-1	0	0	0	0				
x_7	0	0	0	0	0	0			
x_9	-35	-70	3	52	-22	0	0		
x_{13}	1	3	0	-2	0	0	0	-2	
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

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

Γ_2

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
880 ± 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 ± 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=M001218

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	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.600±0.031	10625	DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^0\gamma$

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

 $\omega(782) \Gamma(e^+e^-)\Gamma(i)/\Gamma^2(\text{total})$

NODE=M001225

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

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

6.56±0.12 OUR FIT Error includes scale factor of 1.6.**6.38±0.10 OUR AVERAGE** Error includes scale factor of 1.1.

6.24±0.11±0.08	11.2k	¹ AKHMETSHIN 04	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.70±0.06±0.27		AUBERT,B 04N	BABR	$10.6 e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
6.74±0.04±0.24	1.2M	^{2,3} ACHASOV 03D	RVUE	$0.44-2.00 e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.37±0.35		² DOLINSKY 89	ND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
6.45±0.24		² BARKOV 87	CMD	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.79±0.42	1488	² KURDADZE 83B	OLYA	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.89±0.54	433	² CORDIER 80	DM1	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
7.54±0.84	451	² BENAJSAS 72B	OSPK	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$

• • • 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^- 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.

NODE=M001G2

NODE=M001G2

NODE=M001G;LINKAGE=PT

NODE=M001G;LINKAGE=LP

NODE=M001G;LINKAGE=VH

NODE=M001G2;LINKAGE=BE

 $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma \times \Gamma_2/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

6.18 ±0.11 OUR FIT Error includes scale factor of 1.6.**6.37 ±0.09 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	$0.60-1.38 e^+e^- \rightarrow \pi^0\gamma$
6.50 ±0.11 ±0.20	36k	² ACHASOV 03	SND	$0.60-0.97 e^+e^- \rightarrow \pi^0\gamma$
6.34 ±0.21 ±0.21	10k	³ 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 ⁴ BENAYOUN 10 RVUE 0.4–1.05 e^+e^- 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 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 $(-10.2 \pm 7.0)^\circ$.³ Recalculated by us from the cross section in the peak.⁴ A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-, \pi^+\pi^-\pi^0, \pi^0\gamma, \eta\gamma$ data.

NODE=M001G4

NODE=M001G4

NODE=M001G4;LINKAGE=A

NODE=M001G;LINKAGE=SH

NODE=M001G4;LINKAGE=LP

NODE=M001G4;LINKAGE=BE

 $\Gamma(e^+e^-)/\Gamma_{\text{total}} \times \Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ $\Gamma_9/\Gamma \times \Gamma_3/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

1.225±0.058±0.041 800k ¹ ACHASOV 06 SND $e^+e^- \rightarrow \pi^+\pi^-$

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

1.166±0.036 ² BENAYOUN 13 RVUE 0.4–1.05 e^+e^- 1.05 ±0.08 ³ DAVIER 13 RVUE $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$ ¹ Supersedes ACHASOV 05A.² 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 10.³ From $e^+e^- \rightarrow \pi^+\pi^-(\gamma)$ data of LEES 12G.

NODE=M001G5

NODE=M001G5

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.

3.18±0.28 OUR AVERAGE

3.10±0.31±0.11 33k ¹ACHASOV 07B SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$

3.17^{+1.85}_{–1.31}±0.21 17.4k ²AKHMETSHIN 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 ⁵BENAYOUN 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 A simultaneous fit of $e^+e^- \rightarrow \pi^+\pi^-$, $\pi^+\pi^-\pi^0$, $\pi^0\gamma$, $\eta\gamma$ data.

NODE=M001G3
NODE=M001G3

NODE=M001G3;LINKAGE=AH

NODE=M001G;LINKAGE=AH

NODE=M001G;LINKAGE=AK

NODE=M001G;LINKAGE=BQ

NODE=M001G3;LINKAGE=BE

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

$$\Gamma_9/\Gamma \times \Gamma_{15}/\Gamma$$

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

4.3±1.8±2.2 4.5M ¹ANASTASI 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.

NODE=M001G01
NODE=M001G01

NODE=M001G01;LINKAGE=A

$\omega(782)$ BRANCHING RATIOS

NODE=M001220

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

$$\Gamma_1/\Gamma$$

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 ¹AMBROSINO 08G KLOE 1.0–1.03 $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

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 ³DOLINSKY 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

NODE=M001R21

NODE=M001R21

NODE=M001R21;LINKAGE=AM

NODE=M001R;LINKAGE=VF

NODE=M001R;LINKAGE=ZL

NODE=M001R;LINKAGE=KH

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

$$\Gamma_2/\Gamma$$

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 ¹ACHASOV 16A SND 0.60–1.38 $e^+e^- \rightarrow \pi^0\gamma$

8.09±0.14 ²AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-\pi^0, 2\pi^0\gamma$

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 ⁴ACHASOV 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 ⁷BENAYOUN 96 RVUE $e^+e^- \rightarrow \pi^0\gamma$

8.88±0.62 10k ⁴DOLINSKY 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
NODE=M001R28

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

$\Gamma(\pi^0\gamma)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_2/Γ_1 VALUE (units 10^{-2})

DOCUMENT ID

TECN

COMMENT

9.41±0.23 OUR FIT Error includes scale factor of 2.0.**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 $e^+e^- \rightarrow \pi^0\gamma$ 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.NODE=M001R3
NODE=M001R3

NODE=M001R3;LINKAGE=AL

NODE=M001R3;LINKAGE=VL
NODE=M001R3;LINKAGE=VW $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_3/Γ See also $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$.VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

1.53±0.06 OUR FIT**1.51±0.07 OUR AVERAGE** Error includes scale factor of 1.1.1.52±0.08 ¹ HANHART 18 RVUE $e^+e^- \rightarrow \pi^+\pi^-$ 1.46±0.12±0.02 900k ² AKHMETSHIN 07 $e^+e^- \rightarrow \pi^+\pi^-$ 1.30±0.24±0.05 11.2k ³ AKHMETSHIN 04 CMD2 $e^+e^- \rightarrow \pi^+\pi^-$ 2.38^{+1.77}_{-0.90}±0.18 5.4k ⁴ 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 ^{5,6} ABLIKIM 18C BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$ 1.28±0.22±0.03 970k ^{7,8} ABLIKIM 18C BES3 $\eta'(958) \rightarrow \gamma\pi^+\pi^-$ 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 $4,2\gamma C \rightarrow \pi^+\pi^-C$

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

¹ Dispersive analysis. Value extracted from average of data from AUBERT 09AS, AKHMETSHIN 07, ACHASOV 06, AMBROSINO 11A, BABUSCI 13D, ABLIKIM 16B normalised by PDG evaluation for $\Gamma(\omega \rightarrow e^+e^-)$.² A combined fit of AKHMETSHIN 07, AULCHENKO 06, and AULCHENKO 05.³ Update of AKHMETSHIN 02.⁴ From the $m_{\pi^+\pi^-}$ spectrum taking into account the interference of the $\rho\pi$ and $\omega\pi$ amplitudes.⁵ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and box anomaly components.⁶ 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.⁷ From a fit to $\pi^+\pi^-$ mass using $\rho(770)$ (parametrized with the Gounaris-Sakurai approach), $\omega(782)$, and $\rho(1450)$ components.⁸ 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.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.

NODE=M001R15

NODE=M001R15
NODE=M001R15

OCCUR=2

OCCUR=3

NODE=M001R15;LINKAGE=D

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=M001R;LINKAGE=SN

NODE=M001R;LINKAGE=BY

NODE=M001R15;LINKAGE=H4

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=M001R15;LINKAGE=Q

NODE=M001R15;LINKAGE=F

NODE=M001R15;LINKAGE=B

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

Γ_3/Γ_1

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

VALUE	DOCUMENT ID	TECN	COMMENT

0.0171±0.0007 OUR FIT

0.026 ±0.005 OUR AVERAGE

0.021 $\begin{smallmatrix} +0.028 \\ -0.009 \end{smallmatrix}$	^{1,2} RATCLIFF	72	ASPK	$15 \pi^- p \rightarrow n 2\pi$
0.028 ±0.006	¹ BEHREND	71	ASPK	Photoproduction
0.022 $\begin{smallmatrix} +0.009 \\ -0.01 \end{smallmatrix}$	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 $1.02 \frac{e^+e^- \rightarrow \pi^+\pi^-\pi^0}{\pi^+\pi^-\pi^0}$

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 $\begin{smallmatrix} +0.011 \\ -0.010 \end{smallmatrix}$ 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 $\begin{smallmatrix} +0.05 \\ -0.02 \end{smallmatrix}$		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 $\pi^- p \rightarrow n MM$
>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.**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 6.7–10 γCu

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

4.2 ±0.4 ±0.1	33k	³ ACHASOV	07B	SND 0.6–1.38 $e^+e^- \rightarrow \eta\gamma$
4.44 $^{+2.59}_{-1.83} \pm 0.28$	17.4k	^{4,5} AKHMETSHIN	05	CMD2 0.60–1.38 $e^+e^- \rightarrow \eta\gamma$
5.10 ±0.72 ±0.34	23k	⁶ AKHMETSHIN	01B	CMD2 $e^+e^- \rightarrow \eta\gamma$
0.7 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 ω - ρ 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 $B(\omega(782) \rightarrow e^+e^-) = (7.36 \pm 0.15) \times 10^{-5}$. 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 ω - ρ 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=M001R19NODE=M001R;LINKAGE=EA
NODE=M001R19;LINKAGE=A
NODE=M001R19;LINKAGE=AONODE=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 4–8 $\pi^- p \rightarrow n3\gamma$

¹ Model independent determination.² Solution corresponding to constructive ω - ρ interference.NODE=M001R11
NODE=M001R11NODE=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 ±0.53 ±0.64		ACHASOV	08	SND 0.36–0.97 $e^+e^- \rightarrow \pi^0 e^+ e^-$
8.19 ±0.71 ±0.62		AKHMETSHIN	05A	CMD2 0.72–0.84 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

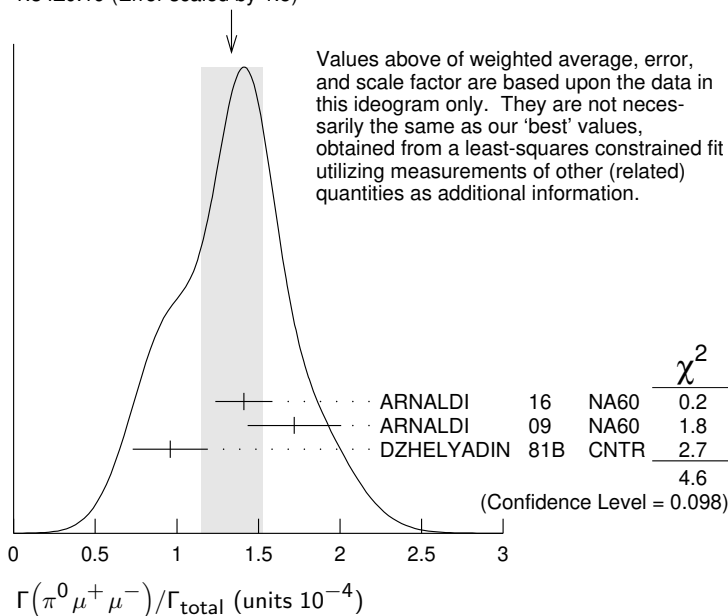
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT

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 $\pi^- p \rightarrow \omega n$

NODE=M001R12
NODE=M001R12

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 $e^+ e^-$

NODE=M001R34
NODE=M001R34

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

Γ_9 / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.736±0.015 OUR FIT				Error includes scale factor of 1.5.
• • • 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

NODE=M001R13
NODE=M001R13

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.

NODE=M001R13;LINKAGE=4P
NODE=M001R13;LINKAGE=ZL
NODE=M001R13;LINKAGE=VF
NODE=M001R13;LINKAGE=E
NODE=M001R13;LINKAGE=A

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

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=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	$\rho \bar{\rho} \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.004	95	BITYUKOV 88B	SPEC	32 $\pi^- p \rightarrow \pi^+ \pi^- \gamma X$

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 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$
<0.05	90	FLATTE 66	HBC	1.2 – 1.7 $K^- p \rightarrow \Lambda \pi^+ \pi^- \gamma$

NODE=M001R4
NODE=M001R4

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1 \times 10^{-3}$	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 $e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

• • • 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

7.9±1.3 OUR FIT**8.5±2.9**

40 ± 14		ALDE 94B	GAM2	$38 \pi^- p \rightarrow \pi^0 \pi^0 \gamma n$

• • • 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	$\pi^- p \rightarrow \omega n$
<1500	90	BENAKSAS 72c	OSPK	$e^+ e^-$
<1400		BALDIN 71	HLBC	2.9 $\pi^+ p$
<1000	90	BARMIN 64	HLBC	1.3–2.8 $\pi^- p$

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 $\pi^- p \rightarrow n \pi^0$
<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**

$6.6 \pm 1.4 \pm 1.7$	4.5M	¹ ANASTASI 17	KLOE	$e^+ e^- \rightarrow \mu^+ \mu^- \gamma$
$9.0 \pm 2.9 \pm 1.1$	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

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

$$\Gamma_{15}/\Gamma_1$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<0.2	90	WILSON	69	OSPK 12 $\pi^- C \rightarrow Fe$
• • • 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

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

$$\Gamma_7/\Gamma_{15}$$

VALUE	EVS	DOCUMENT ID	TECN	COMMENT
1.2 ± 0.6	30	¹ DZHELYADIN	79	CNTR 25–33 $\pi^- p$

NODE=M001R20
NODE=M001R20

¹ Superseded by DZHELYADIN 81B result above.

NODE=M001R20;LINKAGE=S

$$\Gamma(3\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

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 $\pi^- p \rightarrow 3\gamma n$

NODE=M001R27
NODE=M001R27

¹ From direct 3γ decay search.

NODE=M001R27;LINKAGE=A

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

$$\Gamma_{17}/\Gamma$$

Violates C conservation.				
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.001	90	ALDE	94B	GAM2 38 $\pi^- p \rightarrow \eta\pi^0 n$

NODE=M001R25
NODE=M001R25
NODE=M001R25

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

$$(\Gamma_5 + \Gamma_{17})/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.016	90	¹ FLATTE	66	HBC 1.2 – 1.7 $K^- p \rightarrow \Lambda \pi^+ \pi^- MM$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.045	95	JACQUET	69B	HLBC 2.05 $\pi^+ p \rightarrow \pi^+ p \omega$

NODE=M001R8
NODE=M001R8

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

NODE=M001R8;LINKAGE=A

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

$$\Gamma_{17}/\Gamma_2$$

Violates C conservation.				
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	¹ STAROSTIN	09	CRYM $\gamma p \rightarrow \eta\pi^0 p$

NODE=M001R35
NODE=M001R35
NODE=M001R35

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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M001R35;LINKAGE=ST

$$\Gamma(2\pi^0)/\Gamma(\pi^0\gamma)$$

$$\Gamma_{18}/\Gamma_2$$

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

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

$$\Gamma_{19}/\Gamma$$

Violates C conservation.				
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3 × 10 ⁻⁴	90	PROKOSHKIN	95	GAM2 38 $\pi^- p \rightarrow 3\pi^0 n$

NODE=M001R26
NODE=M001R26
NODE=M001R26

$$\Gamma(3\pi^0)/\Gamma(\pi^0\gamma)$$

$$\Gamma_{19}/\Gamma_2$$

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

NODE=M001R37
NODE=M001R37
NODE=M001R37

$$\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$$

$$\Gamma_{19}/\Gamma_1$$

Violates C conservation.				
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.009	90	BARBERIS	01	450 $pp \rightarrow p_f 3\pi^0 p_s$

NODE=M001R31
NODE=M001R31
NODE=M001R31

$\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{20}/Γ_1

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

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 $\Lambda = M_\rho \approx 0.770$ 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

NODE=M001LAM
 NODE=M001LAM

VALUE (GeV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.670 $\pm$ 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 $\pm$ 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;LINKAGE=A

NODE=M001LAM;LINKAGE=B

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

NODE=M001A02
 NODE=M001A02

VALUE (GeV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.709 $\pm$ 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;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.

NODE=M001A00

NODE=M001A00

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

NODE=M001A00;LINKAGE=A

 $\omega(782)$ REFERENCES

NODE=M001

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	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
ACHASOV	06A	Translated from ZETF 130 437.			
AULCHENKO	06	PR D74 014016	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=51133
		JETPL 84 413	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51513
ACHASOV	05A	Translated from ZETFP 84 491.			
		JETP 101 1053	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51045
AKHMETSHIN	05	Translated from ZETF 128 1201.			
AKHMETSHIN	05A	PL B605 26	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50330
AULCHENKO	05	PL B613 29	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=50508
		JETPL 82 743	V.M. Aulchenko <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=51060
AKHMETSHIN	04	Translated from ZETFP 82 841.			
AKHMETSHIN	04B	PL B578 285	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49609
AUBERT,B	04N	PL B580 119	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49610
PDG	04	PR D70 072004	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50184
ACHASOV	03	PL B592 1	S. Eidelman <i>et al.</i>	(PDG Collab.)	REFID=49653
ACHASOV	03D	PL B559 171	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49187
ALOISIO	03	PR D68 052006	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=49577
BENAYOUN	03	PL B561 55	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=49404
ACHASOV	02E	EPJ C29 397	M. Benayoun <i>et al.</i>		REFID=49477
ACHASOV	02F	PR D66 032001	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48815
AKHMETSHIN	02	PL B537 201	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48816
ALOISIO	02D	PL B527 161	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48565
HEISTER	02C	PL B537 21	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ACHASOV	01E	PL B528 19	A. Heister <i>et al.</i>	(ALEPH Collab.)	REFID=48564
AKHMETSHIN	01B	PR D63 072002	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=48311
BARBERIS	01	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
ACHASOV	00	PL B507 14	D. Barberis <i>et al.</i>		REFID=48324
ACHASOV	00D	EPJ C12 25	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47417
		JETPL 72 282	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47882
ACHASOV	00G	Translated from ZETFP 72 411.			
		JETPL 71 355	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47929
AKHMETSHIN	00C	Translated from ZETFP 71 519.			
AULCHENKO	00A	PL B476 33	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47423
		JETP 90 927	V.M. Aulchenko <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47953
CASE	00	Translated from ZETF 117 1067.			
ACHASOV	99E	PR D61 032002	T. Case <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47409
GARDNER	99	PL B462 365	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47391
BENAYOUN	98	PR D59 076002	S. Gardner, H.B. O'Connell		REFID=46919
ABELE	97E	EPJ C2 269	M. Benayoun <i>et al.</i>	(IPNP, NOVO, ADL+)	REFID=45859
BENAYOUN	96	PL B411 361	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45755
PROKOSHKIN	95	ZPHY C72 221	M. Benayoun <i>et al.</i>	(IPNP, NOVO)	REFID=45753
		PD 40 273	Y.D. Prokoshkin, V.D. Samoilenko	(SERP)	REFID=44616
WURZINGER	95	Translated from DANS 342 610.			
ALDE	94B	PR C51 443	R. Wurzinger <i>et al.</i>	(BONN, ORSAY, SACL+)	REFID=45209
AMSLER	94C	PL B340 122	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)	REFID=44100
ALDE	93	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
		PAN 56 1229	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43603
Also		Translated from YAF 56 137.			
AMSLER	93B	ZPHY C61 35	D.M. Alde <i>et al.</i>	(SERP, LAPP, LANL, BELG+)	REFID=43790
WEIDENAUER	93	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43602
ANTONELLI	92	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=43585
DOLINSKY	91	ZPHY C56 15	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=43168
WEIDENAUER	90	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
DOLINSKY	89	ZPHY C47 353	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)	REFID=41368
BITYUKOV	88B	ZPHY C42 511	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41003
		SJNP 47 800	S.I. Bitjukov <i>et al.</i>	(SERP)	REFID=41021
DOLINSKY	88	Translated from YAF 47 1258.			
		SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
KURDADZE	88	Translated from YAF 48 442.			
		JETPL 47 512	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=41121
AULCHENKO	87	Translated from ZETFP 47 432.			
BARKOV	87	PL B186 432	V.M. Aulchenko <i>et al.</i>	(NOVO)	REFID=40007
		JETPL 46 164	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=40280
KURDADZE	86	Translated from ZETFP 46 132.			
		JETPL 43 643	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=40287
BARKOV	85	Translated from ZETFP 43 497.			
DRUZHININ	84	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
KURDADZE	83B	PL 144B 136	V.P. Druzhinin <i>et al.</i>	(NOVO)	REFID=20561
		JETPL 36 274	A.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20244
DZHELYADIN	81B	Translated from ZETFP 36 221.			
CORDIER	80	PL 102B 296	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20242
DZHELYADIN	80	NP B172 13	A. Cordier <i>et al.</i>	(LALO)	REFID=20240
ROOS	80	PL 94B 548	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=10831
BENKHEIRI	79	LNC 27 321	M. Roos, A. Pellinen	(HELS)	REFID=20241
DZHELYADIN	79	NP B150 268	P. Benkheiri <i>et al.</i>	(EPOL, CERN, CDEF+)	REFID=20238
COOPER	78B	PL 84B 143	R.I. Dzheilyadin <i>et al.</i>	(SERP)	REFID=20239
QUENZER	78	NP B146 1	A.M. Cooper <i>et al.</i>	(TATA, CERN, CDEF+)	REFID=20235
VANAPEL...	78	PL 76B 512	A. Quenzer <i>et al.</i>	(LALO)	REFID=20123
WICKLUND	78	NP B133 245	G.W. van Apeldoorn <i>et al.</i>	(ZEEM)	REFID=20234
ANDREWS	77	PR D17 1197	A.B. Wicklund <i>et al.</i>	(ANL)	REFID=20124
GESSAROLI	77	PRL 38 198	D.E. Andrews <i>et al.</i>	(ROCH)	REFID=20120
KEYNE	76	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+)	REFID=20230
Also		PR D14 28	J. Keyne <i>et al.</i>	(LOIC, SHMP)	REFID=20226
KALBFLEISCH	75	PR D8 2789	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20216
AGUILAR...	72B	PR D11 987	G.R. Kalbfleisch, R.C. Strand, J.W. Chapman	(BNL+)	REFID=20223
APEL	72B	PR D6 29	M. Aguilar-Benitez <i>et al.</i>	(BNL)	REFID=20205
BASILE	72B	PL 41B 234	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA)	REFID=20206
BENAKSAS	72	Phil. Conf. 153	M. Basile <i>et al.</i>	(CERN)	REFID=20207
BENAKSAS	72B	PL 39B 289	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20096
BENAKSAS	72C	PL 42B 507	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20209
BORENSTEIN	72	PL 42B 511	D. Benaksas <i>et al.</i>	(ORSAY)	REFID=20517
BROWN	72	PR D5 1559	S.R. Borenstein <i>et al.</i>	(BNL, MICH)	REFID=20215
DAKIN	72	PL 42B 117	R.M. Brown <i>et al.</i>	(ILL, ILLC)	REFID=20211
RATCLIFF	72	PR D6 2321	J.T. Dakin <i>et al.</i>	(PRIN)	REFID=20212
ALVENSLEB...	71C	PL 38B 345	B.N. Ratcliff <i>et al.</i>	(SLAC)	REFID=20102
BALDIN	71	PRL 27 888	H. Alvensleben <i>et al.</i>	(DESY)	REFID=20193
		SJNP 13 758	A.B. Baldin <i>et al.</i>	(ITEP)	REFID=20195
		Translated from YAF 13 1318.			

BEHREND	71	PRL 27 61	H.J. Behrend <i>et al.</i>	(ROCH, CORN, FNAL)
BIZZARRI	71	NP B27 140	R. Bizzarri <i>et al.</i>	(CERN, CDEF)
COYNE	71	NP B32 333	D.G. Coyne <i>et al.</i>	(LRL)
MOFFEIT	71	NP B29 349	K.C. Moffeit <i>et al.</i>	(LRL, UCB, SLAC+)
ABRAMOVI...	70	NP B20 209	M. Abramovich <i>et al.</i>	(CERN)
BIGGS	70B	PRL 24 1201	P.J. Biggs <i>et al.</i>	(DARE)
BIZZARRI	70	PRL 25 1385	R. Bizzarri <i>et al.</i>	(ROMA, SYRA)
ROOS	70	DNPL/R7 173	M. Roos	(CERN)
Proc. Daresbury Study Weekend No. 1.				
AUGUSTIN	69D	PL 28B 513	J.E. Augustin <i>et al.</i>	(ORSAY)
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)
DEINET	69B	PL 30B 426	W. Deinet <i>et al.</i>	(KARL, CERN)
JACQUET	69B	NC 63A 743	F. Jacquet <i>et al.</i>	(EPOL, BERG)
WILSON	69	Private Comm.	R. Wilson	(HARV)
Also		PR 178 2095	A.A. Wehmann <i>et al.</i>	(HARV, CASE, SLAC+)
ASTVACAT...	68	PL 27B 45	R.G. Astvatsaturov <i>et al.</i>	(JINR, MOSU)
BOLLINI	68C	NC 56A 531	D. Bollini <i>et al.</i>	(CERN, BGNA, STRB)
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai	
BARASH	67B	PR 156 1399	N. Barash <i>et al.</i>	(COLU)
FELDMAN	67C	PR 159 1219	M. Feldman <i>et al.</i>	(PENN)
DIGIUGNO	66B	NC 44A 1272	G. Di Giugno <i>et al.</i>	(NAPL, FRAS, TRST)
FLATTE	66	PR 145 1050	S.M. Flatte <i>et al.</i>	(LRL)
JAMES	66	PR 142 896	F.E. James, H.L. Kraybill	(YALE, BNL)
BARBARO-...	65	PRL 14 279	A. Barbaro-Galtieri, R.D. Tripp	(LRL)
BARMIN	64	JETP 18 1289	V.V. Barmin <i>et al.</i>	(ITEP)
		Translated from ZETF 45 1879.		
KRAEMER	64	PR 136 B496	R.W. Kraemer <i>et al.</i>	(JHU, NWES, WOOD)
BUSCHBECK	63	Siena Conf. 1 166	B. Buschbeck <i>et al.</i>	(VIEN, CERN, ANIK)

REFID=20197
REFID=20198
REFID=20201
REFID=20204
REFID=20180
REFID=20184
REFID=20181
REFID=20191

REFID=20169
REFID=20171
REFID=20173
REFID=20176
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REFID=20084
REFID=20055
REFID=20164
REFID=48054
REFID=20160
REFID=20161
REFID=20156
REFID=20157
REFID=10770
REFID=20152
REFID=20149

REFID=10755
REFID=20146

NODE=M002

$\eta'(958)$

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

$\eta'(958)$ 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

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.

OCCUR=2

OCCUR=2

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	
$\Gamma_1 \quad \pi^+ \pi^- \eta$	(42.5 $\pm$ 0.5) %		DESIG=1
$\Gamma_2 \quad \rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	(29.5 $\pm$ 0.4) %		DESIG=9
$\Gamma_3 \quad \rho^0 \gamma$			DESIG=213
$\Gamma_4 \quad \pi^0 \pi^0 \eta$	(22.4 $\pm$ 0.5) %		DESIG=2
$\Gamma_5 \quad \omega \gamma$	(2.52 $\pm$ 0.07) %		DESIG=7
$\Gamma_6 \quad \omega e^+ e^-$	(2.0 $\pm$ 0.4) $\times 10^{-4}$		DESIG=205
$\Gamma_7 \quad \gamma \gamma$	(2.307 $\pm$ 0.033) %		DESIG=6
$\Gamma_8 \quad 3\pi^0$	(2.50 $\pm$ 0.17) $\times 10^{-3}$		DESIG=8
$\Gamma_9 \quad \mu^+ \mu^- \gamma$	(1.13 $\pm$ 0.28) $\times 10^{-4}$		DESIG=20
$\Gamma_{10} \quad \pi^+ \pi^- \mu^+ \mu^-$	< 2.9 $\times 10^{-5}$	90%	DESIG=201
$\Gamma_{11} \quad \pi^+ \pi^- \pi^0$	(3.61 $\pm$ 0.17) $\times 10^{-3}$		DESIG=121
$\Gamma_{12} \quad (\pi^+ \pi^- \pi^0) \text{ S-wave}$	(3.8 $\pm$ 0.5) $\times 10^{-3}$		DESIG=211
$\Gamma_{13} \quad \pi^\mp \rho^\pm$	(7.4 $\pm$ 2.3) $\times 10^{-4}$		DESIG=210
$\Gamma_{14} \quad \pi^0 \rho^0$	< 4 %	90%	DESIG=18
$\Gamma_{15} \quad 2(\pi^+ \pi^-)$	(8.4 $\pm$ 0.9) $\times 10^{-5}$		DESIG=131
$\Gamma_{16} \quad \pi^+ \pi^- 2\pi^0$	(1.8 $\pm$ 0.4) $\times 10^{-4}$		DESIG=202
$\Gamma_{17} \quad 2(\pi^+ \pi^-) \text{ neutrals}$	< 1 %	95%	DESIG=132
$\Gamma_{18} \quad 2(\pi^+ \pi^-) \pi^0$	< 1.8 $\times 10^{-3}$	90%	DESIG=141
$\Gamma_{19} \quad 2(\pi^+ \pi^-) 2\pi^0$	< 1 %	95%	DESIG=15
$\Gamma_{20} \quad 3(\pi^+ \pi^-)$	< 3.1 $\times 10^{-5}$	90%	DESIG=203
$\Gamma_{21} \quad K^\pm \pi^\mp$	< 4 $\times 10^{-5}$	90%	DESIG=207
$\Gamma_{22} \quad \pi^+ \pi^- e^+ e^-$	(2.4 $^{+1.3}_{-1.0}$) $\times 10^{-3}$		DESIG=10
$\Gamma_{23} \quad \pi^+ e^- \nu_e + \text{c.c.}$	< 2.1 $\times 10^{-4}$	90%	DESIG=204
$\Gamma_{24} \quad \gamma e^+ e^-$	(4.91 $\pm$ 0.27) $\times 10^{-4}$		DESIG=28
$\Gamma_{25} \quad \pi^0 \gamma \gamma$	(3.20 $\pm$ 0.24) $\times 10^{-3}$		DESIG=24
$\Gamma_{26} \quad \pi^0 \gamma \gamma$ (non resonant)	(6.2 $\pm$ 0.9) $\times 10^{-4}$		DESIG=212
$\Gamma_{27} \quad \eta \gamma \gamma$	< 1.33 $\times 10^{-4}$	90%	DESIG=214
$\Gamma_{28} \quad 4\pi^0$	< 4.94 $\times 10^{-5}$	90%	DESIG=26
$\Gamma_{29} \quad e^+ e^-$	< 5.6 $\times 10^{-9}$	90%	DESIG=150
$\Gamma_{30} \quad \text{invisible}$	< 6 $\times 10^{-4}$	90%	DESIG=200

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

NODE=M002;CLUMP=B

$\Gamma_{31} \quad \pi^+ \pi^-$	P, CP	< 1.8 $\times 10^{-5}$	90%	DESIG=111
$\Gamma_{32} \quad \pi^0 \pi^0$	P, CP	< 4 $\times 10^{-4}$	90%	DESIG=25
$\Gamma_{33} \quad \pi^0 e^+ e^-$	C [a]	< 1.4 $\times 10^{-3}$	90%	DESIG=16
$\Gamma_{34} \quad \eta e^+ e^-$	C [a]	< 2.4 $\times 10^{-3}$	90%	DESIG=17
$\Gamma_{35} \quad 3\gamma$	C	< 1.0 $\times 10^{-4}$	90%	DESIG=23
$\Gamma_{36} \quad \mu^+ \mu^- \pi^0$	C [a]	< 6.0 $\times 10^{-5}$	90%	DESIG=22
$\Gamma_{37} \quad \mu^+ \mu^- \eta$	C [a]	< 1.5 $\times 10^{-5}$	90%	DESIG=21
$\Gamma_{38} \quad e \mu$	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 19 branching ratios uses 51 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 69.4$ for 43 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	-24							
x_4	-74	-42						
x_5	-7	-6	-2					
x_7	-11	-7	9	-1				
x_8	-17	-9	19	0	2			
x_{11}	-1	-1	-1	0	0	0		
x_{22}	-9	-7	-7	-1	-2	-2	0	
Γ	11	-10	-1	1	-40	0	0	2
	x_1	x_2	x_4	x_5	x_7	x_8	x_{11}	x_{22}

Mode	Rate (MeV)	
Γ_1 $\pi^+ \pi^- \eta$	0.0799 $\pm$ 0.0029	DESIG=1
Γ_2 $\rho^0 \gamma$ (including non-resonant $\pi^+ \pi^- \gamma$)	0.0554 $\pm$ 0.0019	DESIG=9
Γ_4 $\pi^0 \pi^0 \eta$	0.0421 $\pm$ 0.0017	DESIG=2
Γ_5 $\omega \gamma$	0.00474 $\pm$ 0.00020	DESIG=7
Γ_7 $\gamma \gamma$	0.00434 $\pm$ 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_{22} $\pi^+ \pi^- e^+ e^-$	(4.4 $\pm^{+2.3}_{-1.8}$) $\times 10^{-4}$	DESIG=10

$\eta'(958)$ PARTIAL WIDTHS

NODE=M002220

 $\Gamma(\gamma\gamma)$ Γ_7

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.34 $\pm$ 0.14 OUR FIT**4.28 $\pm$ 0.19 OUR AVERAGE**

4.17 $\pm$ 0.10 $\pm$ 0.27	2000	¹ ACCIARRI	98Q L3	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$
4.53 $\pm$ 0.29 $\pm$ 0.51	266	KARCH	92 CBAL	$e^+ e^- \rightarrow e^+ e^- \eta \pi^0 \pi^0$
3.61 $\pm$ 0.13 $\pm$ 0.48		² BEHREND	91 CELL	$e^+ e^- \rightarrow e^+ e^- \eta'(958)$
4.6 $\pm$ 1.1 $\pm$ 0.6	23	BARU	90 MD1	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \gamma$
4.57 $\pm$ 0.25 $\pm$ 0.44		BUTLER	90 MRK2	$e^+ e^- \rightarrow e^+ e^- \eta'(958)$
5.08 $\pm$ 0.24 $\pm$ 0.71	547	³ ROE	90 ASP	$e^+ e^- \rightarrow e^+ e^- 2\gamma$
3.8 $\pm$ 0.7 $\pm$ 0.6	34	AIHARA	88C TPC	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
4.9 $\pm$ 0.5 $\pm$ 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 $\pm$ 0.6 $\pm$ 0.9	143	⁵ GIDAL	87 MRK2	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
4.0 $\pm$ 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_{29}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
$<1.1 \times 10^{-3}$	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. • • •				
$<2.0 \times 10^{-3}$	90	2 ACHASOV 15	SND	$0.958 e^+e^- \rightarrow \pi\pi\eta$
$<2.4 \times 10^{-3}$	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. • • •			
0.95±0.05±0.08	2 KARCH 90	CBAL	$e^+e^- \rightarrow e^+e^-\eta\pi^0\pi^0$
1.00±0.08±0.10	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

 $\Gamma(\pi^+\pi^-\eta) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_1\Gamma_{29}/\Gamma$

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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.				

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 ±0.5 OUR FIT				Error includes scale factor of 1.1.
41.24±0.08±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 ±1.1 ±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

$\Gamma(\pi^+\pi^-\eta(\text{charged decay}))/\Gamma_{\text{total}}$ **0.2789 Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.1185 $\pm$ 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 $\pm$ 0.014	107	RITTENBERG	69	HBC	1.7–2.7 K^-p
0.10 $\pm$ 0.04	10	LONDON	66	HBC	2.24 $K^-p \rightarrow \Lambda 2\pi^+ 2\pi^- \pi^0$
0.07 $\pm$ 0.04	7	BADIER	65B	HBC	3 K^-p

 NODE=M002R3
 NODE=M002R3

 $\Gamma(\pi^+\pi^-\eta(\text{neutral decay}))/\Gamma_{\text{total}}$ **0.7212 Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.306 $\pm$ 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 $\pm$ 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	1.7–2.7 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

 $\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$ **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 $\pm$ 0.020 OUR FIT Error includes scale factor of 1.1.

0.97 $\pm$ 0.09 OUR AVERAGE

0.70 $\pm$ 0.22		AMSLER	04B	CBAR	$0\bar{p}p \rightarrow \pi^+\pi^-\eta$
1.07 $\pm$ 0.17		BELADIDZE	92C	VES	$36\pi^-\text{Be} \rightarrow \pi^-\eta'\eta\text{Be}$
0.92 $\pm$ 0.14	473	DANBURG	73	HBC	2.2 $K^-p \rightarrow \Lambda X^0$
1.11 $\pm$ 0.18	192	JACOBS	73	HBC	2.9 $K^-p \rightarrow \Lambda X^0$

 NODE=M002R27
 NODE=M002R27

 $\Gamma(\pi^0\pi^0\eta)/\Gamma_{\text{total}}$ **Γ_4/Γ**

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

22.4 $\pm$ 0.6 OUR FIT Error includes scale factor of 1.1.

21.36 $\pm$ 0.10 $\pm$ 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 $\pm$ 1.3 $\pm$ 0.4	3.2k	¹ PEDLAR	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

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

 NODE=M002R48
 NODE=M002R48

NODE=M002R48;LINKAGE=PE

 $\Gamma(\pi^0\pi^0\eta(3\pi^0\text{ decay}))/\Gamma_{\text{total}}$ **0.321 Γ_4/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0718 $\pm$ 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 $\pm$ 0.06	4	BENSINGER	70	DBC	2.2 π^+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	$J/\psi \rightarrow \gamma\eta'$
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
NODE=M002R49

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 $\pi^- p \rightarrow n4\gamma$

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	$J/\psi \rightarrow \eta'\gamma$
¹ Obtained from other ABLIKIM 15AD measurements with common systematics taken into account.			

NODE=M002R60
NODE=M002R60

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

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

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

$$\Gamma(\pi^+ \pi^- \text{ neutrals})/\Gamma_{\text{total}} \quad (0.714\Gamma_1 + 0.286\Gamma_4 + 0.89\Gamma_5)/\Gamma$$

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 $K^-p \rightarrow \Lambda \pi^+ \pi^-$ neutrals
0.35 ±0.06	33	BADIER	65B HBC	3 K^-p

NODE=M002R2
NODE=M002R2

$$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

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	$8.45 \pi^- p \rightarrow n \pi^+ \pi^- 2\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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	$3.65 \pi^- p \rightarrow n X^0$

NODE=M002R19
NODE=M002R19

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;LINKAGE=WI

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

$$\Gamma(\gamma\gamma)/\Gamma(\pi^+ \pi^- \eta) \quad \Gamma_7/\Gamma_1$$

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

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

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

$$\Gamma(\gamma\gamma)/\Gamma(\pi^0 \pi^0 \eta) \quad \Gamma_7/\Gamma_4$$

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

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

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

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

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

$$\Gamma(3\pi^0)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

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	$J/\psi \rightarrow \gamma(3\pi^0)$

NODE=M002R55
NODE=M002R55

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

² Superseded by ABLIKIM 17.

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^{-4}) CL%

DOCUMENT ID

TECN

COMMENT

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

<0.29	90	¹ ABLIKIM	130	BES3	$J/\psi \rightarrow \gamma\eta'$
<2.4	90	² NAIK	09	CLEO	$J/\psi \rightarrow \gamma\eta'$

¹ Using $\Gamma_2/\Gamma = (29.3 \pm 0.6)\%$ from PDG 12.² Not independent of measured value of Γ_{10}/Γ_1 from NAIK 09.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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.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 ± 0.18 OUR FIT**3.61 ± 0.18 OUR AVERAGE**

3.591 ± 0.054 ± 0.174	6067	ABLIKIM	17	BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$
4.28 ± 0.49 ± 1.11	78	¹ ABLIKIM	15P	BES3	$J/\psi \rightarrow K^+K^-3\pi$
3.7 ^{+1.1} _{-0.9} ± 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 ± 0.15 ± 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=M002R21NODE=M002R21;LINKAGE=A
NODE=M002R21;LINKAGE=NA
NODE=M002R21;LINKAGE=B $\Gamma((\pi^+\pi^-\pi^0) \text{ S-wave})/\Gamma_{\text{total}}$ Γ_{12}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

37.63 ± 0.77 ± 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 ± 0.60 ± 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

 $\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\eta)$ Γ_{11}/Γ_1 VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

8.5 ± 0.4 OUR FIT Error includes scale factor of 1.1.**8.28 ^{+2.49}_{-2.12} ± 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 ± 2) × 10⁻³ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 ± 0.20) × 10^{-2}$. 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

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

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

NODE=M002R10
 NODE=M002R10

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

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.4±0.9±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 $K^- p$

NODE=M002R24
 NODE=M002R24

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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = (5.25 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R24;LINKAGE=A

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

NODE=M002R24;LINKAGE=NA

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

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

NODE=M002R04
 NODE=M002R04

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow 2(\pi^+ \pi^-))/\Gamma(\eta'(958) \rightarrow \pi^+ \pi^- \eta)] / [B(\eta \rightarrow 2\gamma)]$
 $< 1.4 \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R04;LINKAGE=NA

 $\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.38±0.02	84		¹ ABLIKIM	14M BES3	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R51
 NODE=M002R51

• • • 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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958))$
 $= (5.25 \pm 0.07) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M002R51;LINKAGE=A

² Not independent of measured value of Γ_{16}/Γ_1 from NAIK 09.

NODE=M002R51;LINKAGE=NA

 $\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma(\pi^+ \pi^- \eta)$ Γ_{16}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R05
 NODE=M002R05

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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R05;LINKAGE=NA

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	DANBURG 73	HBC	2.2 $K^- p \rightarrow \Lambda X^0$

NODE=M002R22
 NODE=M002R22

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

<0.01	90		RITTENBERG 69	HBC	1.7–2.7 $K^- p$

 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$ Γ_{18}/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	1.7–2.7 $K^- p$

NODE=M002R23
 NODE=M002R23

¹ Not independent of measured value of Γ_{18}/Γ_1 from NAIK 09.

NODE=M002R23;LINKAGE=NA

 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma(\pi^+ \pi^- \eta)$ Γ_{18}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	¹ NAIK	09 CLEO	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R06
 NODE=M002R06

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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R06;LINKAGE=NA

 $\Gamma(2(\pi^+ \pi^-) 2\pi^0)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.01	95	KALBFLEISCH 64B	HBC	$K^- p \rightarrow \Lambda 2(\pi^+ \pi^-) + \text{MM}$

NODE=M002R16
 NODE=M002R16

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

<0.01	90	LONDON 66	HBC	Compilation

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

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_{20}/Γ_1 from NAIK 09.

NODE=M002R07
NODE=M002R07

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

 $\Gamma(3(\pi^+\pi^-))/\Gamma(\pi^+\pi^-\eta)$

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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.				

NODE=M002R08
NODE=M002R08

NODE=M002R08;LINKAGE=NA

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

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

NODE=M002R61
NODE=M002R61

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

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.4 $^{+1.3}_{-0.9}$					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_{22}/Γ_1 from NAIK 09.

NODE=M002R12
NODE=M002R12

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.5 $^{+3.0}_{-2.3}$				OUR FIT

5.52 $^{+3.00}_{-2.30} \pm 0.03$	8	¹ NAIK 09	CLEO	$J/\psi \rightarrow \gamma \eta'$

¹ NAIK 09 reports $[\Gamma(\eta'(958) \rightarrow \pi^+\pi^-e^+e^-)/\Gamma(\eta'(958) \rightarrow \pi^+\pi^-\eta)] / [B(\eta \rightarrow 2\gamma)] = (14_{-5}^{+7} \pm 3) \times 10^{-3}$ which we multiply by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.2 $\pm 0.4 \pm 0.5$	429	ABLIKIM 130	BES3	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R56
NODE=M002R56

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.0	90	ABLIKIM 13G	BES3	$J/\psi \rightarrow \phi \eta'$

NODE=M002R54
NODE=M002R54

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.9	90	BRIERE 00	CLEO	10.6 e^+e^-

NODE=M002R40
NODE=M002R40

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.13 $\pm 0.09 \pm 0.07$	864	ABLIKIM 150	BES3	$J/\psi \rightarrow \gamma e^+e^-$

NODE=M002R00
NODE=M002R00

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.20 $\pm 0.07 \pm 0.23$	3.4k	ABLIKIM 17T	BES3	$J/\psi \rightarrow \gamma \eta'$

NODE=M002R64
NODE=M002R64

$\Gamma(\pi^0\gamma\gamma(\text{non resonant}))/\Gamma_{\text{total}}$ Γ_{26}/Γ

VALUE (units 10^{-4})	EVT5	DOCUMENT ID	TECN	COMMENT
$6.16 \pm 0.64 \pm 0.67$	655	ABLIKIM	17T BES3	$J/\psi \rightarrow \gamma\eta'$

NODE=M002R65
 NODE=M002R65

 $\Gamma(\pi^0\gamma\gamma)/\Gamma(\pi^0\pi^0\eta)$ Γ_{25}/Γ_4

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<37	90	ALDE	87B GAM2	$38 \pi^- p \rightarrow n4\gamma$

NODE=M002R35
 NODE=M002R35

 $\Gamma(\eta\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.33 \times 10^{-4}$	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_{28}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.94 \times 10^{-5}$ (CL = 90%)		[$<3.2 \times 10^{-4}$ (CL = 90%) OUR 2020 BEST LIMIT]		
$<4.94 \times 10^{-5}$	90	ABLIKIM	20E BES3	$J/\psi \rightarrow \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<3.2 \times 10^{-4}$	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_{28}/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	$38 \pi^- p \rightarrow n8\gamma$

NODE=M002R37
 NODE=M002R37

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{29}/Γ

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	$e^+e^- \rightarrow \pi^+\pi^-\eta$

NODE=M002R39
 NODE=M002R39

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;LINKAGE=B

NODE=M002R39;LINKAGE=A

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<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

 $\Gamma(\text{invisible})/\Gamma(\gamma\gamma)$ Γ_{30}/Γ_7

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

 $\Gamma(\text{invisible})/\Gamma(\pi^+\pi^-\eta)$ Γ_{30}/Γ_1

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<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 $B(\eta \rightarrow 2\gamma) = 39.41 \times 10^{-2}$.

NODE=M002R09
 NODE=M002R09

NODE=M002R09;LINKAGE=NA

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.18	90	¹ AAIJ	17D LHCB	$D_s^+ \rightarrow \pi^+\pi^-\pi^+$

NODE=M002R20
 NODE=M002R20

• • • 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	$1.7-2.7 K^- p$

OCCUR=2

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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.25 \times 10^{-3}$.

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;LINKAGE=A
NODE=M002R20;LINKAGE=AL

NODE=M002R20;LINKAGE=MO
NODE=M002R20;LINKAGE=MR

$\Gamma(\pi^0 \pi^0)/\Gamma_{\text{total}}$					Γ_{32}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
< 4×10^{-4}	90	¹ ABLIKIM	11G	BES3	$J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M002R53
NODE=M002R53

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 $B(J/\psi(1S) \rightarrow \gamma \eta'(958)) = 5.25 \times 10^{-3}$.

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	$10.6 e^+ e^-$

NODE=M002R8
NODE=M002R8

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

< 13	90	RITTENBERG	65	HBC	$2.7 K^- p$

$\Gamma(\eta e^+ e^-)/\Gamma_{\text{total}}$					Γ_{34}/Γ
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	
< 2.4	90	BRIERE	00	CLEO	$10.6 e^+ e^-$

NODE=M002R9
NODE=M002R9

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

< 11	90	RITTENBERG	65	HBC	$2.7 K^- p$

$\Gamma(3\gamma)/\Gamma(\pi^0 \pi^0 \eta)$					Γ_{35}/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_{36}/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_{37}/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_{38}/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

Re(α) decay parameter

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M002A0
NODE=M002A0

• • • 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	$\eta' \rightarrow \eta \pi^+ \pi^-$

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

 $\text{Im}(\alpha)$ 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	$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M002IA0

NODE=M002IA0

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 $C = 0$.⁴ From the data of DAUBER 64, RITTENBERG 69, AGUILAR-BENITEZ 72B, JACOBS 73, and DANBURG 73.

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;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. • • •				
$-0.056 \pm 0.004 \pm 0.002$	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	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.072 \pm 0.007 \pm 0.008$		¹ GONZALEZ-S...18A	RVUE	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.047 \pm 0.011 \pm 0.003$	44k	² ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.066 \pm 0.016 \pm 0.003$	15k	³ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.127 \pm 0.016 \pm 0.008$	20k	⁴ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

² See ABLIKIM 11 for the full correlation matrix.

³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay.

⁴ From $\eta' \rightarrow \eta\pi^+\pi^-$ decay.

NODE=M002DPA
NODE=M002DPA

OCCUR=2

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. • • •				
$-0.049 \pm 0.006 \pm 0.006$	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	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.052 \pm 0.001 \pm 0.002$		¹ GONZALEZ-S...18A	RVUE	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.069 \pm 0.019 \pm 0.009$	44k	² ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$-0.063 \pm 0.028 \pm 0.004$	15k	³ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.106 \pm 0.028 \pm 0.014$	20k	⁴ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

² See ABLIKIM 11 for the full correlation matrix.

³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay.

⁴ From $\eta' \rightarrow \eta\pi^+\pi^-$ decay.

NODE=M002DPB
NODE=M002DPB

OCCUR=2

NODE=M002DPB;LINKAGE=A
NODE=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. • • •				
$-0.063 \pm 0.004 \pm 0.003$	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	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.051 \pm 0.008 \pm 0.006$		¹ GONZALEZ-S...18A	RVUE	$\eta' \rightarrow \eta\pi^0\pi^0$
$-0.073 \pm 0.012 \pm 0.003$	44k	² ABLIKIM 11	BES3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$
$0.018 \pm 0.078 \pm 0.006$	15k	³ BLIK 09	GAM4	$32.5 \pi^- p \rightarrow \eta' n$
$-0.082 \pm 0.017 \pm 0.008$	20k	⁴ DOROFEEV 07	VES	$27 \pi^- p \rightarrow \eta' n,$ $\pi^- A \rightarrow \eta' \pi^- A^*$

¹ Theoretical analysis of ADLARSON 18A using resonance chiral perturbation theory to one loop.

² See ABLIKIM 11 for the full correlation matrix.

³ From $\eta' \rightarrow \eta\pi^0\pi^0$ decay. If $c \equiv 0$ from Bose-Einstein symmetry, $d = -0.067 \pm 0.020 \pm 0.003$.

⁴ From $\eta' \rightarrow \eta\pi^+\pi^-$ decay.

NODE=M002DPD
NODE=M002DPD

OCCUR=2

NODE=M002DPD;LINKAGE=A
NODE=M002DPD;LINKAGE=AB
NODE=M002DPD;LINKAGE=BL
NODE=M002DPD;LINKAGE=DO

$\eta'(958)$ β 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 ±0.046 ±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

NODE=M002235

See the note on η decay parameters in the Stable Particle Particle Listings
for definition of this parameter.

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. LANDS-
BERG 85, eq. (3.8), for a detailed definition.

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

NODE=M002FFL

NODE=M002FFL;LINKAGE=A

$\eta'(958)$ REFERENCES

NODE=M002

ABLIKIM	20E	PR D101 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60252
ABLIKIM	19AW	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
AAIJ	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
Translated from YAF 72 258.					
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
Translated from YAF 71 2161.					

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
		Translated from YAF 68 401.			
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	PL B249 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 (erratum)	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
DZHELYADIN	81	PL 105B 239	R.I. Dzheilyadin <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 review on "Scalar Mesons below 2 GeV."

NODE=M003

NODE=M003

NODE=M003PP

NODE=M003PP

 $f_0(980)$ T-MATRIX POLE $\sqrt{s}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1003^{+5}_{-27}) - i(21^{+10}_{-8})$	¹ GARCIA-MAR..11	RVUE	Compilation
$(996 \pm 7) - i(25^{+10}_{-6})$	² GARCIA-MAR..11	RVUE	Compilation
$(973^{+39}_{-127}) - i(11^{+189}_{-11})$	³ PELAEZ	04A 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 PROTOPOPESCU 73 using Roy equations.			
² Reanalysis of the K_{e4} data of BATLEY 10C and the $\pi N \rightarrow \pi\pi N$ data of HYAMS 73, GRAYER 74, and PROTOPOPESCU 73 using GKPY equations.			
³ Reanalysis of data from PROTOPOPESCU 73, ESTABROOKS 74, GRAYER 74, and COHEN 80 in the unitarized ChPT model.			

OCCUR=2

NODE=M003PP;LINKAGE=B

NODE=M003PP;LINKAGE=C

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. • • •				
$992.8 \pm 0.8 \pm 1.0$		¹ ALBRECHT	20 RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
$992.0^{+8.5}_{-7.5} \pm 8.6$		² AAIJ	19H LHCB	$p\bar{p} \rightarrow D^\pm X$
989.4 ± 1.3	424	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$
989.9 ± 0.4	706	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma 3\pi$
996^{+4}_{-14}		³ MOUSSALLAM11	RVUE	Compilation
981 ± 43		⁴ MENNESSIER	10 RVUE	Compilation
1030^{+30}_{-10}		⁵ ANISOVICH	09 RVUE	$0.0 \bar{p}p, \pi N$
$977^{+11}_{-9} \pm 1$	44	⁶ ECKLUND	09 CLEO	$4.17 e^+ e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
$982.2 \pm 1.0^{+8.1}_{-8.0}$		⁷ UEHARA	08A BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
$976.8 \pm 0.3^{+10.1}_{-0.6}$	64k	⁸ AMBROSINO	07 KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$984.7 \pm 0.4^{+2.4}_{-3.7}$	64k	⁹ AMBROSINO	07 KLOE	$1.02 e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
973 ± 3	262 ± 30	¹⁰ AUBERT	07AKBABR	$10.6 e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$
970 ± 7	54 ± 9	¹⁰ AUBERT	07AKBABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \pi^0 \gamma$
953 ± 20	2.6k	¹¹ BONVICINI	07 CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$985.6^{+1.2}_{-1.5} \pm 1.1$		¹² MORI	07 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
$983.0 \pm 0.6^{+4.0}_{-3.0}$		¹³ AMBROSINO	06B KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$977.3 \pm 0.9^{+3.7}_{-4.3}$		¹⁴ AMBROSINO	06B KLOE	$1.02 e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
950 ± 9	4286	¹⁵ GARMASH	06 BELL	$B^+ \rightarrow K^+ \pi^+ \pi^-$
965 ± 10		¹⁶ ABLIKIM	05 BES2	$J/\psi \rightarrow \phi \pi^+ \pi^-, \phi K^+ K^-$
1031 ± 8		¹⁷ ANISOVICH	03 RVUE	
1037 ± 31		TIKHOMIROV	03 SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
973 ± 1	2438	¹⁸ ALOISIO	02D KLOE	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$977 \pm 3 \pm 2$	848	¹⁹ AITALA	01A E791	$D_s^+ \rightarrow \pi^- \pi^+ \pi^+$
969.8 ± 4.5	419	²⁰ ACHASOV	00H SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
985^{+16}_{-12}	419	^{21,22} ACHASOV	00H SND	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$976 \pm 5 \pm 6$		²³ AKHMETSHIN 99B	CMD2	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$977 \pm 3 \pm 6$	268	²³ AKHMETSHIN 99C	CMD2	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$
$975 \pm 4 \pm 6$		²⁴ AKHMETSHIN 99C	CMD2	$e^+ e^- \rightarrow \pi^0 \pi^0 \gamma$

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OCCUR=2

975 $\pm 4 \pm 6$		25 AKHMETSHIN 99C	CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma,$ $\pi^0\pi^0\gamma$	OCCUR=3
985 ± 10		BARBERIS	99	OMEG 450 $pp \rightarrow$ $p_s p_f K^+ K^-$	
982 ± 3		BARBERIS	99B	OMEG 450 $pp \rightarrow p_s p_f \pi^+ \pi^-$	
982 ± 3		BARBERIS	99C	OMEG 450 $pp \rightarrow p_s p_f \pi^0 \pi^0$	
987 $\pm 6 \pm 6$		26 BARBERIS	99D	OMEG 450 $pp \rightarrow K^+ K^-,$ $\pi^+ \pi^-$	
989 ± 15		BELLAZZINI	99	GAM4 450 $pp \rightarrow pp \pi^0 \pi^0$	
991 ± 3		27 KAMINSKI	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
~ 980		27 OLLER	99	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 993.5		OLLER	99B	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 987		27 OLLER	99C	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
957 ± 6		28 ACKERSTAFF	98Q	OPAL $Z \rightarrow f_0 X$	
960 ± 10		ALDE	98	GAM4	
1015 ± 15		27 ANISOVICH	98B	RVUE Compilation	
1008		29 LOCHER	98	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$	
955 ± 10		28 ALDE	97	GAM2 450 $pp \rightarrow pp \pi^0 \pi^0$	
994 ± 9		30 BERTIN	97C	OBLX 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	
993.2 $\pm 6.5 \pm 6.9$		31 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 ± 5	3k	32 ALDE	95B	GAM2 38 $\pi^- p \rightarrow \pi^0 \pi^0 n$	
960 ± 10	10k	33 ALDE	95B	GAM2 38 $\pi^- p \rightarrow \pi^0 \pi^0 n$	OCCUR=2
994 ± 5		AMSLER	95B	CBAR 0.0 $\bar{p}p \rightarrow 3\pi^0$	
~ 996		34 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 ± 6		35 ANISOVICH	95	RVUE	
1015		JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$	
983		36 BUGG	94	RVUE $\bar{p}p \rightarrow \eta 2\pi^0$	
973 ± 2		37 KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$	
988		38 ZOU	94B	RVUE	
988 ± 10		39 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 ± 4.0		28 AGUILAR-...	91	EHS 400 pp	
979 ± 4		40 ARMSTRONG	91	OMEG 300 $pp \rightarrow pp\pi\pi,$ $ppK\bar{K}$	
956 ± 12		BREAKSTONE	90	SFM $pp \rightarrow pp\pi^+ \pi^-$	
959.4 ± 6.5		28 AUGUSTIN	89	DM2 $J/\psi \rightarrow \omega\pi^+ \pi^-$	
978 ± 9		28 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 ± 4		40 GIDAL	81	MRK2 $J/\psi \rightarrow \pi^+ \pi^- X$	
975		41 ACHASOV	80	RVUE	
986 ± 10		40 AGUILAR-...	78	HBC 0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
969 ± 5		40 LEEPER	77	ASPK 2-2.4 $\pi^- p \rightarrow$ $\pi^+ \pi^- n, K^+ K^- n$	
987 ± 7		40 BINNIE	73	CNTR $\pi^- p \rightarrow nMM$	
1012 ± 6		42 GRAYER	73	ASPK 17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
1007 ± 20		42 HYAMS	73	ASPK 17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
997 ± 6		42 PROTOPOP...	73	HBC 7 $\pi^+ p \rightarrow \pi^+ p\pi^+ \pi^-$	

¹ 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 ($\eta\eta'$). Second solution $977.8 \pm 0.6 \pm 1.6$ MeV.

² 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.

³ Pole position. Used Roy equations.

⁴ 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.

⁵ On sheet II in a 2-pole solution. The other pole is found on sheet III at (850–100i) MeV

⁶ Using a relativistic Breit-Wigner function and taking into account the finite D_s mass.

⁷ Breit-Wigner mass. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0 K K}/g_{f_0 \pi\pi} = 0$.

⁸ In the kaon-loop fit.

⁹ In the no-structure fit.

¹⁰ Systematic errors not estimated.

¹¹ FLATTE 76 parameterization. $g_{f_0 \pi\pi} = 329 \pm 96$ MeV/c² assuming $g_{f_0 K\bar{K}}/g_{f_0 \pi\pi} = 2$.

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- 12 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.
- 13 In the kaon-loop fit following formalism of ACHASOV 89.
- 14 In the no-structure fit assuming a direct coupling of ϕ to $f_0 \gamma$.
- 15 FLATTE 76 parameterization. Supersedes GARMASH 05.
- 16 FLATTE 76 parameterization, $g_{f_0 K \bar{K}} / g_{f_0 \pi \pi} = 4.21 \pm 0.25 \pm 0.21$.
- 17 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.
- 18 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.
- 19 Coupled-channel Breit-Wigner, couplings $g_\pi = 0.09 \pm 0.01 \pm 0.01$, $g_K = 0.02 \pm 0.04 \pm 0.03$.
- 20 Supersedes ACHASOV 98i. Using the model of ACHASOV 89.
- 21 Supersedes ACHASOV 98i.
- 22 In the “narrow resonance” approximation.
- 23 Assuming $\Gamma(f_0) = 40$ MeV.
- 24 From a narrow pole fit taking into account $f_0(980)$ and $f_0(1200)$ intermediate mechanisms.
- 25 From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- 26 Supersedes BARBERIS 99 and BARBERIS 99B
- 27 T-matrix pole.
- 28 From invariant mass fit.
- 29 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i)$ MeV.
- 30 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i)$ MeV.
- 31 Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- 32 At high $|t|$.
- 33 At low $|t|$.
- 34 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.
- 35 Combined fit of ALDE 95B, ANISOVICH 94, AMSLER 94D.
- 36 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i)$ MeV.
- 37 From sheet II pole position.
- 38 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.
- 39 On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i)$ MeV.
- 40 From coupled channel analysis.
- 41 Coupled channel analysis with finite width corrections.
- 42 Included in AGUILAR-BENITEZ 78 fit.

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 NODE=M003M1;LINKAGE=L

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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.

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VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10 to 100 OUR ESTIMATE				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
61.3 ± 1.3 ± 4.4		¹ ALBRECHT	20	RVUE 0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta$, $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$
15.3 ± 4.7	424	ABLIKIM	15P	BES3 $J/\psi \rightarrow K^+ K^- 3\pi$
9.5 ± 1.1	706	ABLIKIM	12E	BES3 $J/\psi \rightarrow \gamma 3\pi$
48 $\pm \frac{22}{6}$		² MOUSSALLAM11	RVUE	Compilation
36 ± 22		³ MENNESSIER	10	RVUE Compilation
70 $\pm \frac{20}{32}$		⁴ ANISOVICH	09	RVUE 0.0 $\bar{p} p$, πN
91 $\pm \frac{30}{22}$ ± 3	44	⁵ ECKLUND	09	CLEO 4.17 $e^+ e^- \rightarrow D_s^- D_s^{*+} + \text{c.c.}$
66.9 ± 2.2 $\frac{+17.6}{-12.5}$		⁶ UEHARA	08A	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
65 ± 13	262 ± 30	⁷ AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \phi \pi^+ \pi^- \gamma$

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81 ± 21	54 ± 9	7 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}		8 MORI	07 BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$	
61 ± 9 ⁺¹⁴ ₋₈	2584	9 GARMASH	05 BELL	$B^+ \rightarrow K^+\pi^+\pi^-$	
64 ± 16		10 ANISOVICH	03 RVUE		
121 ± 23		TIKHOMIROV	03 SPEC	40.0 $\pi^- \rightarrow K_S^0 K_S^0 K_L^0 X$	
~ 70		11 BRAMON	02 RVUE	1.02 $e^+e^- \rightarrow \pi^0 \pi^0 \gamma$	
44 ± 2 ± 2	848	12 AITALA	01A E791	$D_s^+ \rightarrow \pi^-\pi^+\pi^+$	
201 ± 28	419	13 ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$	OCCUR=2
122 ± 13	419	14,15 ACHASOV	00H SND	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$	
56 ± 20		16 AKHMETSHIN	99C CMD2	$e^+e^- \rightarrow \pi^0 \pi^0 \gamma$	
65 ± 20		BARBERIS	99 OMEG	450 $pp \rightarrow p_s p_f K^+ K^-$	
		BARBERIS	99B OMEG	450 $pp \rightarrow p_s p_f \pi^+ \pi^-$	
80 ± 10		BARBERIS	99C OMEG	450 $pp \rightarrow p_s p_f \pi^0 \pi^0$	
80 ± 10		BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
48 ± 12 ± 8		17 BARBERIS	99D OMEG	450 $pp \rightarrow p p \pi^0 \pi^0$	
65 ± 25		BELLAZZINI	99 GAM4	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
71 ± 14		18 KAMINSKI	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 28		18 OLLER	99 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 25		OLLER	99B RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
~ 14		18 OLLER	99C RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \eta\eta$	
70 ± 20		ALDE	98 GAM4		
86 ± 16		18 ANISOVICH	98B RVUE	Compilation	
54		19 LOCHER	98 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
69 ± 15		20 ALDE	97 GAM2	450 $pp \rightarrow p p \pi^0 \pi^0$	
38 ± 20		21 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$	
~ 100		22 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	23 ALDE	95B GAM2	38 $\pi^- p \rightarrow \pi^0 \pi^0 n$	OCCUR=2
95 ± 20	10k	24 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		25 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		26 ANISOVICH	95 RVUE		
30		JANSSEN	95 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
74		27 BUGG	94 RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$	
29 ± 2		28 KAMINSKI	94 RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$	
46		29 ZOU	94B RVUE		
48 ± 12		30 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		20 AGUILAR-...	91 EHS	400 pp	
72 ± 8		31 ARMSTRONG	91 OMEG	300 $pp \rightarrow p p \pi\pi, p p K\bar{K}$	
110 ± 30		BREAKSTONE	90 SFM	$pp \rightarrow p p \pi^+ \pi^-$	
29 ± 13		20 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		31 GIDAL	81 MRK2	$J/\psi \rightarrow \pi^+ \pi^- X$	
70 to 300		32 ACHASOV	80 RVUE		
100 ± 80		33 AGUILAR-...	78 HBC	0.7 $\bar{p}p \rightarrow K_S^0 K_S^0$	
30 ± 8		31 LEEPER	77 ASPK	2-2.4 $\pi^- p \rightarrow \pi^+ \pi^- n, K^+ K^- n$	
48 ± 14		31 BINNIE	73 CNTR	$\pi^- p \rightarrow n MM$	
32 ± 10		34 GRAYER	73 ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
30 ± 10		34 HYAMS	73 ASPK	17 $\pi^- p \rightarrow \pi^+ \pi^- n$	
54 ± 16		34 PROTOPOP...	73 HBC	7 $\pi^+ p \rightarrow \pi^+ p \pi^+ \pi^-$	

- ¹ 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 ($\eta\eta'$). Second solution $97.8 \pm 1.2 \pm 5.4$ MeV.
- ² Pole position. Used Roy equations.
- ³ 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.
- ⁴ On sheet II in a 2-pole solution. The other pole is found on sheet III at $(850-100i)$ MeV
- ⁵ Using a relativistic Breit-Wigner function and taking into account the finite D_S mass.
- ⁶ Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^2 K K / g_{f_0}^2 \pi\pi = 0$.
- ⁷ Systematic errors not estimated.
- ⁸ Breit-Wigner $\pi\pi$ width. Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0}^2 K K / g_{f_0}^2 \pi\pi = 4.21 \pm 0.25 \pm 0.21$ from ABLIKIM 05.
- ⁹ Breit-Wigner, solution 1, PWA ambiguous.
- ¹⁰ 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.
- ¹¹ Using the data of AKHMETSHIN 99C, ACHASOV 00H, and ALOISIO 02D.
- ¹² Breit-Wigner width.
- ¹³ Supersedes ACHASOV 98i. Using the model of ACHASOV 89.
- ¹⁴ Supersedes ACHASOV 98i.
- ¹⁵ In the "narrow resonance" approximation.
- ¹⁶ From the combined fit of the photon spectra in the reactions $e^+ e^- \rightarrow \pi^+ \pi^- \gamma$, $\pi^0 \pi^0 \gamma$.
- ¹⁷ Supersedes BARBERIS 99 and BARBERIS 99B
- ¹⁸ T-matrix pole.
- ¹⁹ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(1039-93i)$ MeV.
- ²⁰ From invariant mass fit.
- ²¹ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(963-29i)$ MeV.
- ²² Reanalysis of data from HYAMS 73, GRAYER 74, SRINIVASAN 75, and ROSSELET 77 using the interfering amplitude method.
- ²³ At high $|t|$.
- ²⁴ At low $|t|$.
- ²⁵ 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.
- ²⁶ Combined fit of ALDE 95B, ANISOVICH 94,
- ²⁷ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(996-103i)$ MeV.
- ²⁸ From sheet II pole position.
- ²⁹ 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.
- ³⁰ On sheet II in a 2 pole solution. The other pole is found on sheet III at $(978-28i)$ MeV.
- ³¹ From coupled channel analysis.
- ³² Coupled channel analysis with finite width corrections.
- ³³ From coupled channel fit to the HYAMS 73 and PROTOPODESCU 73 data. With a simultaneous fit to the $\pi\pi$ phase-shifts, inelasticity and to the $K_S^0 K_S^0$ invariant mass.
- ³⁴ Included in AGUILAR-BENITEZ 78 fit.

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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	
0.31 ± 0.05 -0.04	OUR AVERAGE				
0.32 ± 0.05	¹ DAI	14A	RVUE	Compilation	
0.286 ± 0.017 ± 0.211 -0.070	² UEHARA	08A	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	
0.205 ± 0.095 ± 0.147 -0.083 -0.117	³ MORI	07	BELL	10.6 $e^+e^- \rightarrow e^+e^-\pi^+\pi^-$	
0.42 ± 0.06 ± 0.18	⁴ OEST	90	JADE	$e^+e^- \rightarrow e^+e^-\pi^0\pi^0$	

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

0.16 ± 0.01	⁵ MENNESSIER 11	RVUE	
0.29 ± 0.21 ^{+0.02} _{-0.07}	⁶ MOUSSALLAM11	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 dispersive analysis with phases from GARCIA-MARTIN 11A and BUETTIKER 04 as input.

NODE=M003W4;LINKAGE=D

² Using finite width corrections according to FLATTE 76 and ACHASOV 05, and the ratio $g_{f_0} K K / g_{f_0} \pi \pi = 0$.

NODE=M003W4;LINKAGE=UE

³ 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

⁴ OEST 90 quote systematic errors ^{+0.08}_{-0.18}. We use ±0.18. Observed 60 events.

NODE=M003W4;LINKAGE=H

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

NODE=M003R1
NODE=M003R1

• • • 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 ($0^- p \bar{p} \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$), 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=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

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
AAJ	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
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)	REFID=55923
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
GARCIA-MAR...	11	PRL 107 072001	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=16761
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=54121
MENNESSIER	11	PL B696 40	G. Mennessier, S. Narison, X.-G. Wang		REFID=53637
MOUSSALLAM	11	EPJ C71 1814	B. Moussallam		REFID=53975
BATLEY	10C	EPJ C70 635	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=53567
MENNESSIER	10	PL B688 59	G. Mennessier, S. Narison, X.-G. Wang		REFID=53657
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	(CLEO Collab.)	REFID=52719
ECKLUND	09	PR D80 052009	K.M. Ecklund <i>et al.</i>		REFID=53041
BATLEY	08A	EPJ C54 411	J.R. Batley <i>et al.</i>	(CERN NA48/2 Collab.)	REFID=52487
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
AMBROSINO	07	EPJ C49 473	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51616
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
BONVICINI	07	PR D76 012001	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=51721
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)	REFID=51652
AMBROSINO	06B	PL B634 148	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=51043
AUBERT	06O	PR D74 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51141
GARMASH	06	PRL 96 251803	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=51162
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
ACHASOV	05	PR D72 013006	N.N. Achasov, G.N. Shestakov		REFID=50762
GARMASH	05	PR D71 092003	A. Garmash <i>et al.</i>	(BELLE Collab.)	REFID=50641
ABLIKIM	04G	PR D70 092002	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50187
BUETTAKER	04	EPJ C33 409	P. Buettiker, S. Descotes-Genon, B. Moussallam	(MADU)	REFID=56428; ERROR=6
PELAEZ	04A	MPL A19 2879	J.R. Pelaez		REFID=50347
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>		REFID=49401
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>		REFID=49423
ALLOISIO	02D	Translated from YAF 66 860	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=48824
ANISOVICH	02D	PAN 65 1545	V.V. Anisovich <i>et al.</i>		REFID=48831
BRAMON	02	Translated from YAF 65 1583	A. Bramon <i>et al.</i>		REFID=49178
ACHASOV	01F	PR D63 094007	N.N. Achasov, V.V. Gubin	(Novosibirsk SND Collab.)	REFID=48312
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48004
AITALA	01B	PRL 86 770	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)	REFID=48005
ACHASOV	00H	PL B485 349	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47930
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
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	99C	PL B453 325	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46923
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
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington		REFID=46931
KAMINSKI	99	EPJ C9 141	R. Kaminski, L. Lesniak, B. Loiseau	(CRAC, PARIN)	REFID=46927
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
ACHASOV	98I	PL B440 442	M.N. Achasov <i>et al.</i>		REFID=46600
ACKERSTAFF	98Q	EPJ C4 19	K. Ackerstaff <i>et al.</i>	(OPAL Collab.)	REFID=46145
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
ANISOVICH	98B	Translated from YAF 62 446	V.V. Anisovich <i>et al.</i>		REFID=46331
LOCHER	98	SPI 41 419	M.P. Locher <i>et al.</i>	(PSI)	REFID=46372
ALDE	97	EPJ C4 317	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
ISHIDA	96	PTP 95 745	S. Ishida <i>et al.</i>	(TOKY, MIYA, KEK)	REFID=45770
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
ALDE	95B	ZPHY C66 375	D.M. Alde <i>et al.</i>	(GAMS Collab.)	REFID=44375
AMSLER	95B	PL B342 433	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44377
AMSLER	95D	PL B355 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44441
ANISOVICH	95	PL B355 363	V.V. Anisovich <i>et al.</i>	(PNPI, SERP)	REFID=44442
JANSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADL, JULI)	REFID=44508
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
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
ZOU	94B	PR D50 591	B.S. Zou, D.V. Bugg	(LOQM)	REFID=44072
MORGAN	93	PR D48 1185	D. Morgan, M.R. Pennington	(RAL, DURH)	REFID=43614
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)	REFID=43172
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)	REFID=41637
ARMSTRONG	91	ZPHY C51 351	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41744
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
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
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
ABACHI	86B	Translated from YAF 48 436	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)	REFID=20394
LONGACRE	86	PRL 57 1990	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
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)	REFID=20390
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)	REFID=20386
ACHASOV	80	SJNP 32 566	N.N. Achasov, S.A. Devyanin, G.N. Shestakov	(NOVM)	REFID=20458
COHEN	80	PR D22 2595	D. Cohen <i>et al.</i>	(ANL) IJP	REFID=20381
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)	REFID=20382
AGUILAR-...	78	NP B140 73	M. Aguilar-Benitez <i>et al.</i>	(MADR, BOMB+)	REFID=20368
CASON	78	PRL 41 271	N.M. Cason <i>et al.</i>	(NDAM, ANL)	REFID=20370
LEEPER	77	PR D16 2054	R.J. Leeper <i>et al.</i>	(ISU)	REFID=20365
ROSSELET	77	PR D15 574	L. Rosselet <i>et al.</i>	(GEVA, SACL)	REFID=11004
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)	REFID=20446
WETZEL	76	NP B115 208	W. Wetzel <i>et al.</i>	(ETH, CERN, LOIC)	REFID=20362
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
GRAYR	74	NP B75 189	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20113
BINNIE	73	PRL 31 1534	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=20343
GRAYR	73	Tallahassee	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=20347
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
PROTOPOP...	73	PR D7 1279	S.D. Protopopescu <i>et al.</i>	(LBL)	REFID=20108

$a_0(980)$

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

See the review on "Scalar Mesons below 2 GeV."

NODE=M036

NODE=M036

NODE=M036PP

NODE=M036PP

NODE=M036PP;LINKAGE=A

NODE=M036205

NODE=M036MX
→ UNCHECKED ←

NODE=M036MX;LINKAGE=A

NODE=M036M1
NODE=M036M1 **$a_0(980)$ T-MATRIX POLE $\sqrt{s}$**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$(1117^{+24}_{-320}) - i(12^{+43}_{-12})$	¹ PELAEZ	04A RVUE	$\pi\pi \rightarrow \pi\pi, \pi K \rightarrow \pi K$
¹ Reanalysis of data from LINGLIN 73, ESTABROOKS 78, and ASTON 88 in the unitarized ChPT model.			

 $a_0(980)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
980 ±20 OUR ESTIMATE	Mass determination very model dependent		
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$1000.7^{+12.9}_{-0.7}$	¹ LU	20 RVUE	$\gamma\gamma \rightarrow \pi^0\eta, K_S^0 K_S^0$
¹ T-matrix pole on sheet II.			

 $\eta\pi$ FINAL STATE ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$1004.1 \pm 1.5 \pm 6.5$		¹ ALBRECHT	20	CBAR	$0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0 K^+ K^-$
$982.5 \pm 1.6 \pm 1.1$	16.9k	² AMBROSINO	09F	KLOE	$1.02 e^+ e^- \rightarrow \eta\pi^0\gamma$
986 ± 4		ANISOVICH	09	RVUE	$0.0 \bar{p}p, \pi N$
$982.3 \pm 0.6 \pm 3.1$ $-0.7 -4.7$		³ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0\eta$
$987.4 \pm 1.0 \pm 3.0$		^{4,5} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
$989.1 \pm 1.0 \pm 3.0$		^{5,6} BUGG	08A	RVUE 0	$\bar{p}p \rightarrow \pi^0\pi^0\eta$
$985 \pm 4 \pm 6$	318	ACHARD	02B	L3	$183-209 e^+ e^- \rightarrow e^+ e^- \eta\pi^+ \pi^-$
995 ± 52 -10	36	⁷ ACHASOV	00F	SND	$e^+ e^- \rightarrow \eta\pi^0\gamma$
994 ± 33 -8	36	⁸ 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		⁹ OLLER	99	RVUE	$\eta\pi, K\bar{K}$
~ 1009.2		⁹ OLLER	99B	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
993.1 ± 2.1		¹⁰ TEIGE	99	B852	$18.3 \pi^- p \rightarrow \eta\pi^+ \pi^- n$
988 ± 6		⁹ 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		¹¹ AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$
984 ± 4	1040	¹¹ ARMSTRONG	91B	OMEG ±	$300 pp \rightarrow p p \eta\pi^+ \pi^-$
976 ± 6		ATKINSON	84E	OMEG ±	$25-55 \gamma p \rightarrow \eta\pi n$
986 ± 3	500	¹² EVANGELIS...	81	OMEG ±	$12 \pi^- p \rightarrow \eta\pi^+ \pi^- \pi^- p$
990 ± 7	145	¹² GURTU	79	HBC ±	$4.2 K^- p \rightarrow \Lambda\eta 2\pi$
980 ± 11	47	CONFORTO	78	OSPK -	$4.5 \pi^- p \rightarrow pX^-$
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

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ T-matrix pole with 2 poles, 2 channels, pole mass on adjacent sheet $1002.4 \pm 1.4 \pm 6.6$ MeV.
- ² Using the model of ACHASOV 89 and ACHASOV 03B.
- ³ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.
- ⁴ Parameterizes couplings to $\bar{K}K$, $\pi\eta$, and $\pi\eta'$.
- ⁵ Using AMSLER 94D and ABELE 98.
- ⁶ From the T-matrix pole on sheet II.
- ⁷ Using the model of ACHASOV 89. Supersedes ACHASOV 98B.
- ⁸ Using the model of JAFFE 77. Supersedes ACHASOV 98B.
- ⁹ T-matrix pole.
- ¹⁰ Breit-Wigner fit, average between $a_0^\pm$ and a_0^0 . The fit favors a slightly heavier $a_0^\pm$.
- ¹¹ From a single Breit-Wigner fit.
- ¹² From $f_1(1285)$ decay.

 $K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$947.7^{+5.5}_{-5.0} \pm 6.6$		¹ AAIJ	19H LHCb	$pp \rightarrow D^\pm X$
$925 \pm 5 \pm 8$	190k	² AAIJ	16N LHCb	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
~ 1053		³ OLLER	99C RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
982 ± 3		⁴ ABELE	98 CBAR	$0.0 \bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
975 ± 15		BERTIN	98B OBLX	$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
976 ± 6	316	DEBILLY	80 HBC	$1.2-2 \bar{p}p \rightarrow f_1(1285)\omega$
1016 ± 10	100	⁵ ASTIER	67 HBC	$0.0 \bar{p}p$
1003.3 ± 7.0	143	^{6,7} 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 T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.
- ⁵ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.
- ⁶ 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).
- ⁷ Plus systematic errors.

 $a_0(980)$ WIDTH

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.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$97.2 \pm 1.9 \pm 5.7$		¹ ALBRECHT	20 CBAR		$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$73.2^{+25.4}_{-5.2}$		² LU	20 RVUE		$\gamma\gamma \rightarrow \pi^0 \eta, K_S^0 K_S^0$
$75.6 \pm 1.6^{+17.4}_{-10.0}$		³ UEHARA	09A BELL		$\gamma\gamma \rightarrow \pi^0 \eta$
$80.2 \pm 3.8 \pm 5.4$		⁴ BUGG	08A RVUE 0		$\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
$50 \pm 13 \pm 4$	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		⁵ OLLER	99 RVUE		$\eta\pi, K\bar{K}$
~ 112		⁵ 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		⁵ ANISOVICH	98B RVUE		Compilation
65 ± 10		⁶ BERTIN	98B OBLX $\pm$		$0.0 \bar{p}p \rightarrow K^\pm K_S \pi^\mp$
~ 100		TORNQVIST	96 RVUE		$\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi,$ $\eta\pi$
202		JANSSEN	95 RVUE		$\eta\pi \rightarrow \eta\pi, K\bar{K}, K\pi,$ $\eta\pi$
$54.12 \pm 0.34 \pm 0.12$		AMSLER	94C CBAR		$0.0 \bar{p}p \rightarrow \omega \eta \pi^0$

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NODE=M036M1;LINKAGE=UENODE=M036M1;LINKAGE=BP
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NODE=M036M1;LINKAGE=A
NODE=M036M1;LINKAGE=RNODE=M036M2
NODE=M036M2

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NODE=M036M2;LINKAGE=Q
NODE=M036M2;LINKAGE=A
NODE=M036M2;LINKAGE=01

NODE=M036M2;LINKAGE=S

NODE=M036210

NODE=M036W1
→ UNCHECKED ←

OCCUR=2

54 ±10		⁷ AMSLER	92	CBAR	0.0 $\bar{p}p \rightarrow \eta\eta\pi^0$
95 ±14	1040	⁷ ARMSTRONG	91B	OMEG ±	300 $pp \rightarrow p\rho\eta\pi^+\pi^-$
62 ±15	500	⁸ EVANGELIS...	81	OMEG ±	12 $\pi^- p \rightarrow \eta\pi^+\pi^-\pi^- p$
60 ±20	145	⁸ GURTU	79	HBC ±	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
60 ⁺⁵⁰ ₋₃₀	47	CONFORTO	78	OSPK -	4.5 $\pi^- p \rightarrow \rho X^-$
86.0 ^{+60.0} _{-50.0}	50	CORDEN	78	OMEG ±	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		⁹ FLATTE	76	RVUE -	4.2 $K^- p \rightarrow \Lambda\eta 2\pi$
16.0 ^{+25.0} _{-16.0}	70	¹⁰ WELLS	75	HBC -	3.1-6 $K^- p \rightarrow \Lambda\eta 2\pi$
30 ± 5	150	¹¹ DEFOIX	72	HBC ±	0.7 $\bar{p}p \rightarrow 7\pi$
40 ±15		CAMPBELL	69	DBC ±	2.7 $\pi^+ d$
60 ±30	15	MILLER	69B	HBC -	4.5 $K^- N \rightarrow \eta\pi\Lambda$
80 ±30	30	AMMAR	68	HBC ±	5.5 $K^- p \rightarrow \Lambda\eta 2\pi$

¹ T-matrix pole with 2 poles, 2 channels, pole width on adjacent sheet $127.0 \pm 2.3 \pm 6.7$ MeV.

² T-matrix pole on sheet II.

³ From a fit with the S-wave amplitude including two interfering Breit-Wigners plus a background term.

⁴ From the T-matrix pole on sheet II, using AMSLER 94D and ABELE 98.

⁵ T-matrix pole.

⁶ The $\eta\pi$ width.

⁷ From a single Breit-Wigner fit.

⁸ From $f_1(1285)$ decay.

⁹ Using a two-channel resonance parametrization of GAY 76B data.

¹⁰ Weak evidence only for $a_0(980)^+$ production.

¹¹ This number has very little meaning. Error is much too small. Vlada

$K\bar{K}$ ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
92 ± 8		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. • • •					
~ 24		² OLLER	99C	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}$
~ 25	100	³ ASTIER	67	HBC ±	
57 ± 13	143	⁴ ROSENFELD	65	RVUE ±	

¹ T-matrix pole on sheet II, the pole on sheet III is at 1006-i49 MeV.

² T-matrix pole.

³ ASTIER 67 includes data of BARLOW 67, CONFORTO 67, ARMENTEROS 65.

⁴ Plus systematic errors.

$a_0(980)$ 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^-	

$a_0(980)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$

VALUE (keV)	DOCUMENT ID	TECN
0.30 ± 0.10	¹ AMSLER	98 RVUE

¹ Using $\Gamma_{\gamma\gamma} B(a_0(980) \rightarrow \eta\pi) = 0.24 \pm 0.08$ keV.

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NODE=M036W1;LINKAGE=BU

NODE=M036W1;LINKAGE=AN

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NODE=M036W1;LINKAGE=A

NODE=M036W1;LINKAGE=R

NODE=M036W1;LINKAGE=F

NODE=M036W1;LINKAGE=W

NODE=M036W1;LINKAGE=01

NODE=M036W2

NODE=M036W2

NODE=M036W2;LINKAGE=Q

NODE=M036W2;LINKAGE=AN

NODE=M036W2;LINKAGE=A

NODE=M036W2;LINKAGE=S

NODE=M036215;NODE=M036

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=8

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=5;OUR EST;→ UNCHECKED ←

DESIG=6

NODE=M036217

NODE=M036W4

NODE=M036W4

NODE=M036W4;LINKAGE=A

$a_0(980) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M036220

 $\Gamma(\eta\pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_5 / \Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.21 $^{+0.08}_{-0.04}$ OUR AVERAGE				

NODE=M036G1
NODE=M036G1

0.128 $^{+0.003+0.502}_{-0.002-0.043}$		¹ UEHARA	09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
0.28 $\pm 0.04 \pm 0.10$	44	OEST	90	JADE	$e^+ e^- \rightarrow e^+ e^- \pi^0 \eta$
0.19 $\pm 0.07 \pm 0.10$ -0.07		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=M036G1;LINKAGE=UE

 $\Gamma(\eta\pi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_1 \Gamma_6 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	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
0.183 ± 0.024 OUR AVERAGE	Error includes scale factor of 1.2.			
0.57 ± 0.16	¹ BARGIOTTI	03	OBLX	$\bar{p} p$
0.23 ± 0.05	² ABELE	98	CBAR	$0.0 \bar{p} p \rightarrow K_L^0 K^\pm \pi^\mp$
0.166 $\pm 0.01 \pm 0.02$	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 $\pm 0.001 \pm 0.035$	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 $\pm 0.07 \pm 0.05$	⁶ BUGG	08A	RVUE	$0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
~ 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	$\pm 0.7 \bar{p} \rightarrow 7\pi$

NODE=M036R2
NODE=M036R2

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

² Using $\pi^0 \pi^0 \eta$ 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.

NODE=M036R;LINKAGE=BG
NODE=M036R2;LINKAGE=Q
NODE=M036R2;LINKAGE=L
NODE=M036R2;LINKAGE=ANODE=M036R2;LINKAGE=AN
NODE=M036R2;LINKAGE=BU $\Gamma(\eta' \pi) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE	EVTS	DOCUMENT ID	TECN	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 10.1σ significance. Earlier observed by ABLIKIM 17K in the $\chi_{c1} \rightarrow \eta \pi^+ \pi^-$ decay with a 8.9σ significance.

NODE=M036R00;LINKAGE=A

 $\Gamma(\rho\pi) / \Gamma(\eta\pi)$ Γ_4 / Γ_1

$\rho\pi$ forbidden.					
<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. ● ● ●					
<0.25	70	¹ AMMAR	70	HBC	$\pm 4.1, 5.5 K^- p \rightarrow \Lambda \eta 2\pi$

NODE=M036R1
NODE=M036R1
NODE=M036R1

¹ Not clear if they really observed the $a_0(980)$ 3 standard deviations.

NODE=M036R1;LINKAGE=01

 $a_0(980)$ REFERENCES

NODE=M036

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
CHEN	20A	PR D102 012002	Y.Q. Chen <i>et al.</i>	(BELLE Collab.)	REFID=60333
LU	20	EPJ C80 436	J. Lu, B. Moussallam		REFID=60436
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
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57953
AAIJ	16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
AMBROSINO	09F	PL B681 5	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=53105
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev		REFID=52719
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)	REFID=53002
BUGG	08A	PR D78 074023	D.V. Bugg	(LOQM)	REFID=52578
PELAEZ	04A	MPL A19 2879	J.R. Pelaez	(MADU)	REFID=50347
ACHASOV	03B	PR D68 014006	N.N. Achasov, A.V. Kiselev		REFID=49476
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)	REFID=49217

ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACHASOV	00F	PL B479 53	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47928
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47964
OLLER	99	PR D60 099906 (erratum)	J.A. Oller <i>et al.</i>		REFID=46899
OLLER	99B	NP A652 407 (erratum)	J.A. Oller, E. Oset		REFID=46924
OLLER	99C	PR D60 074023	J.A. Oller, E. Oset		REFID=47386
TEIGE	99	PR D59 012001	S. Teige <i>et al.</i>	(BNL E852 Collab.)	REFID=46613
ABELE	98	PR D57 3860	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45863
ACHASOV	98B	PL B438 441	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=46317
AMSLER	98	RMP 70 1293	C. Amsler		REFID=46601
ANISOVICH	98B	SPU 41 419	V.V. Anisovich <i>et al.</i>		REFID=46331
		Translated from UFN 168 481.			
BARBERIS	98C	PL B440 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=46346
BERTIN	98B	PL B434 180	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=46351
TORNQVIST	96	PRL 76 1575	N.A. Tornqvist, M. Roos	(HELS)	REFID=44507
JANSSEN	95	PR D52 2690	G. Janssen <i>et al.</i>	(STON, ADLD, JULI)	REFID=44508
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44091
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44093
BUGG	94	PR D50 4412	D.V. Bugg <i>et al.</i>	(LOQM)	REFID=44078
AMSLER	92	PL B291 347	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=43169
ARMSTRONG	91B	ZPHY C52 389	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=41862
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)	REFID=41358
ACHASOV	89	NP B315 465	N.N. Achasov, V.N. Ivanchenko		REFID=48021
ASTON	88	NP B296 493	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40262
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)	REFID=41023
		Translated from YAF 48 436.			
ANTREASYAN	86	PR D33 1847	D. Antreasyan <i>et al.</i>	(Crystal Ball Collab.)	REFID=20469
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=20624
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
DEBILLY	80	NP B176 1	L. de Billy <i>et al.</i>	(CURIN, LAUS, NEUC+)	REFID=20461
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)	REFID=20456
CONFORTO	78	LNC 23 419	B. Conforto <i>et al.</i>	(RHEL, TINTO, CHIC+)	REFID=20451
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)	REFID=20452
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)	REFID=22443
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20447
JAFFE	77	PR D15 267,281	R. Jaffe	(MIT)	REFID=43673
FLATTE	76	PL 63B 224	S.M. Flatte	(CERN)	REFID=20446
GAY	76B	PL 63B 220	J.B. Gay <i>et al.</i>	(CERN, AMST, NIJM) JP	REFID=20445
WELLS	75	NP B101 333	J. Wells <i>et al.</i>	(OXF)	REFID=20444
LINGLIN	73	NP B55 408	D. Linglin	(CERN)	REFID=22428
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
AMMAR	70	PR D2 430	R. Ammar <i>et al.</i>	(KANS, NWES, ANL, WISC)	REFID=20428
BARNES	69C	PRL 23 610	V.E. Barnes <i>et al.</i>	(BNL, SYRA)	REFID=20418
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)	REFID=20419
MILLER	69B	PL 29B 255	D.H. Miller <i>et al.</i>	(PURD)	REFID=20424
Also		PR 188 2011	W.L. Yen <i>et al.</i>	(PURD)	REFID=20425
AMMAR	68	PRL 21 1832	R. Ammar <i>et al.</i>	(NWES, ANL)	REFID=20412
ASTIER	67	PL 25B 294	A. Astier <i>et al.</i>	(CDEF, CERN, IRAD)	REFID=20405
		Includes data of BARLOW 67, CONFORTO 67, and ARMENTEROS 65.			
BARLOW	67	NC 50A 701	J. Barlow <i>et al.</i>	(CERN, CDEF, IRAD, LIVP)	REFID=20041
CONFORTO	67	NP B3 469	G. Conforto <i>et al.</i>	(CERN, CDEF, IPNP+)	REFID=20411
ARMENTEROS	65	PL 17 344	R. Armenteros <i>et al.</i>	(CERN, CDEF)	REFID=20396
ROSENFELD	65	Oxford Conf. 58	A.H. Rosenfeld	(LRL)	REFID=20399

NODE=M004

 $\phi(1020)$

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

 $\phi(1020)$ MASS

NODE=M004M

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	$0.60-1.38 e^+e^- \rightarrow \eta\gamma$
1019.483±0.011±0.025	272k	⁴ AKHMETSHIN	04 CMD2	$e^+e^- \rightarrow K_L^0 K_S^0$
1019.42 ±0.05	1900k	⁵ ACHASOV	01E SND	$e^+e^- \rightarrow K^+K^-$, $K_S K_L, \pi^+\pi^-\pi^0$
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	$e^+e^- \rightarrow \pi^+\pi^- \geq 2\gamma$
1019.51 ±0.07 ±0.10	11169	AKHMETSHIN	98 CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^0$
1019.5 ±0.4		BARBERIS	98 OMEG	$450 pp \rightarrow pp2K^+2K^-$
1019.42 ±0.06	55600	AKHMETSHIN	95 CMD2	$e^+e^- \rightarrow \text{hadrons}$
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	$11.8 \text{ polar. } pp \rightarrow KK$
1019.67 ±0.17	25080	⁸ PELLINEN	82 RVUE	
1019.52 ±0.13	3681	BUKIN	78C OLYA	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1018.4 ±0.5 ±0.1		⁹ ALBRECHT	20 CBAR	$0.9 \bar{p}p \rightarrow K^+K^-\pi^0$
1019.54 ±0.10 ±0.51		¹⁰ AAIJ	19H LHCb	$pp \rightarrow D^\pm X$
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±0.008±0.080	542k	¹¹ AKHMETSHIN	08 CMD2	$1.02 e^+e^- \rightarrow K^+K^-$
1019.63 ±0.07	12540	¹² AUBERT,B	05J BABR	$D^0 \rightarrow \bar{K}^0 K^+K^-$
1019.8 ±0.7		ARMSTRONG	86 OMEG	$85 \pi^+/pp \rightarrow \pi^+/p4Kp$
1020.1 ±0.11	5526	¹² ATKINSON	86 OMEG	$20-70 \gamma p$
1019.7 ±1.0		BEBEK	86 CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
1019.411±0.008	642k	¹³ DIJKSTRA	86 SPEC	$100-200 \pi^\pm, \bar{p}, p, K^\pm, \text{ on Be}$
1020.9 ±0.2		¹² FRAME	86 OMEG	$13 K^+p \rightarrow \phi K^+p$
1021.0 ±0.2		¹² ARMSTRONG	83B OMEG	$18.5 K^-p \rightarrow K^-K^+\Lambda$
1020.0 ±0.5		¹² ARMSTRONG	83B OMEG	$18.5 K^-p \rightarrow K^-K^+\Lambda$
1019.7 ±0.3		¹² BARATE	83 GOLI	$190 \pi^- \text{ Be} \rightarrow 2\mu X$
1019.8 ±0.2 ±0.5	766	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	¹² BALDI	77 CNTR	$10 \pi^- p \rightarrow \pi^- \phi p$
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	$2 \gamma p \rightarrow pK^+K^-$
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	¹⁴ AGUILAR-...	72B HBC	$3.9, 4.6 K^-p \rightarrow \Lambda K^+K^-$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

1019.9 ±0.5	100	¹⁴ AGUILAR-...	72B	HBC	3.9,4.6 $K^- p \rightarrow K^- p K^+ K^-$
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 $K^- p \rightarrow \Sigma / \Lambda K \bar{K}$

OCCUR=2

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 $\rho(770)$, $\phi(1020)$ 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 $\eta \gamma$ decays 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 From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the Triple-M amplitude in the multi-meson model of AOUE 18.

NODE=M004M;LINKAGE=I

¹¹ Strongly correlated with AKHMETSHIN 04.

NODE=M004M;LINKAGE=AH

¹² Systematic errors not evaluated.

NODE=M004M;LINKAGE=A

¹³ Weighted and scaled average of 12 measurements of DIJKSTRA 86.

NODE=M004M;LINKAGE=B

¹⁴ 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 $2 \gamma p \rightarrow p K^+ K^-$
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. ● ● ●				
4.249±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	⁷ AKHMETSHIN	08	CMD2 1.02 $e^+ e^- \rightarrow K^+ K^-$
4.28 ±0.13	12540	⁸ 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	^{6,8} AKERLOF	77	SPEC 400 $pA \rightarrow K^+ K^- X$
4.5 ±0.8	500	^{6,8} 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 $K^- p \rightarrow K \bar{K} n$

NODE=M004W

OCCUR=2

- 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 Strongly correlated with AKHMETSHIN 04.
- ⁸ Systematic errors not evaluated.

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=AH

NODE=M004W;LINKAGE=A

NODE=M004215;NODE=M004

 $\phi(1020)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 K^+K^-	(49.2 $\pm$ 0.5) %	S=1.3
Γ_2 $K_L^0 K_S^0$	(34.0 $\pm$ 0.4) %	S=1.3
Γ_3 $\rho\pi + \pi^+\pi^-\pi^0$	(15.24 $\pm$ 0.33) %	S=1.2
Γ_4 $\rho\pi$		
Γ_5 $\pi^+\pi^-\pi^0$		
Γ_6 $\eta\gamma$	(1.303 $\pm$ 0.025) %	S=1.2
Γ_7 $\pi^0\gamma$	(1.30 $\pm$ 0.05) $\times 10^{-3}$	
Γ_8 $\ell^+\ell^-$	—	
Γ_9 e^+e^-	(2.973 $\pm$ 0.034) $\times 10^{-4}$	S=1.3
Γ_{10} $\mu^+\mu^-$	(2.86 $\pm$ 0.19) $\times 10^{-4}$	
Γ_{11} ηe^+e^-	(1.08 $\pm$ 0.04) $\times 10^{-4}$	
Γ_{12} $\pi^+\pi^-$	(7.3 $\pm$ 1.3) $\times 10^{-5}$	
Γ_{13} $\omega\pi^0$	(4.7 $\pm$ 0.5) $\times 10^{-5}$	
Γ_{14} $\omega\gamma$	< 5 %	CL=84%
Γ_{15} $\rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%
Γ_{16} $\pi^+\pi^-\gamma$	(4.1 $\pm$ 1.3) $\times 10^{-5}$	
Γ_{17} $f_0(980)\gamma$	(3.22 $\pm$ 0.19) $\times 10^{-4}$	S=1.1
Γ_{18} $\pi^0\pi^0\gamma$	(1.12 $\pm$ 0.06) $\times 10^{-4}$	
Γ_{19} $\pi^+\pi^-\pi^+\pi^-$	(3.9 $^{+2.8}_{-2.2}$) $\times 10^{-6}$	
Γ_{20} $\pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6 $\times 10^{-6}$	CL=90%
Γ_{21} $\pi^0 e^+e^-$	(1.33 $^{+0.07}_{-0.10}$) $\times 10^{-5}$	
Γ_{22} $\pi^0\eta\gamma$	(7.27 $\pm$ 0.30) $\times 10^{-5}$	S=1.5
Γ_{23} $a_0(980)\gamma$	(7.6 $\pm$ 0.6) $\times 10^{-5}$	
Γ_{24} $K^0\bar{K}^0\gamma$	< 1.9 $\times 10^{-8}$	CL=90%
Γ_{25} $\eta'(958)\gamma$	(6.22 $\pm$ 0.21) $\times 10^{-5}$	
Γ_{26} $\eta\pi^0\pi^0\gamma$	< 2 $\times 10^{-5}$	CL=90%
Γ_{27} $\mu^+\mu^-\gamma$	(1.4 $\pm$ 0.5) $\times 10^{-5}$	
Γ_{28} $\rho\gamma\gamma$	< 1.2 $\times 10^{-4}$	CL=90%
Γ_{29} $\eta\pi^+\pi^-$	< 1.8 $\times 10^{-5}$	CL=90%
Γ_{30} $\eta\mu^+\mu^-$	< 9.4 $\times 10^{-6}$	CL=90%
Γ_{31} $\eta U \rightarrow \eta e^+e^-$	< 1 $\times 10^{-6}$	CL=90%
Γ_{32} invisible	< 1.7 $\times 10^{-4}$	CL=90%

DESIG=1

DESIG=2

DESIG=24

DESIG=16

DESIG=3

DESIG=4

DESIG=7

DESIG=256;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=6

DESIG=17

DESIG=8

DESIG=25

DESIG=10

DESIG=12

DESIG=9

DESIG=20

DESIG=19

DESIG=15

DESIG=14

DESIG=21

DESIG=22

DESIG=23

DESIG=257

DESIG=194

DESIG=195

DESIG=196

DESIG=250

DESIG=255

DESIG=26

DESIG=259

DESIG=260

Lepton Family number (LF) violating modes

Γ_{33} $e^\pm\mu^\mp$	LF < 2	$\times 10^{-6}$	CL=90%

NODE=M004;CLUMP=A

DESIG=258

CONSTRAINED FIT INFORMATION

An overall fit to 30 branching ratios uses 82 measurements and one constraint to determine 14 parameters. The overall fit has a $\chi^2 = 63.7$ for 69 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	-78									
x_3	-59	-4								
x_6	-23	19	6							
x_7	-15	14	4	10						
x_9	54	-52	-17	-38	-27					
x_{10}	-7	7	2	5	3	-13				
x_{12}	-3	3	1	2	2	-6	1			
x_{13}	-5	4	1	3	2	-8	1	1		
x_{17}	0	0	0	0	0	0	0	0	0	
x_{18}	-11	10	3	19	5	-20	2	1	2	0
x_{19}	-1	1	0	1	0	-2	0	0	0	0
x_{23}	0	0	0	0	0	0	0	0	0	0
x_{25}	-8	6	2	33	3	-12	2	1	1	0
	x_1	x_2	x_3	x_6	x_7	x_9	x_{10}	x_{12}	x_{13}	x_{17}
x_{19}	0									
x_{23}	0	0								
x_{25}	6	0	0							
	x_{18}	x_{19}	x_{23}							

$\phi(1020)$ PARTIAL WIDTHS

$\Gamma(\eta\gamma)$

VALUE (keV) DOCUMENT ID TECN COMMENT

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

$58.9 \pm 0.5 \pm 2.4$ ACHASOV 00 SND $e^+e^- \rightarrow \eta\gamma$

Γ_6

NODE=M004218

NODE=M004W6
NODE=M004W6

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

VALUE (keV) DOCUMENT ID TECN COMMENT

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

$5.40 \pm 0.16^{+0.43}_{-0.40}$ ACHASOV 00 SND $e^+e^- \rightarrow \pi^0\gamma$

Γ_7

NODE=M004W7
NODE=M004W7

$\Gamma(\ell^+\ell^-)$

VALUE (keV) DOCUMENT ID TECN COMMENT

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

$1.320 \pm 0.017 \pm 0.015$ 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.

Γ_8

NODE=M004W5
NODE=M004W5

NODE=M004W5;LINKAGE=AM

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

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.

$1.235 \pm 0.006 \pm 0.022$ ¹ AKHMETSHIN 11 CMD2 $1.02 e^+e^- \rightarrow \phi$
 $1.32 \pm 0.05 \pm 0.03$ ² AMBROSINO 05 KLOE $1.02 e^+e^- \rightarrow e^+e^-$
 1.28 ± 0.05 AKHMETSHIN 95 CMD2 $1.02 e^+e^- \rightarrow \phi$

Γ_9

NODE=M004W8
NODE=M004W8

→ UNCHECKED ←

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;LINKAGE=AK

NODE=M004W8;LINKAGE=AM

$$(\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-))^{\frac{1}{2}} \quad (\Gamma_9\Gamma_{10})^{\frac{1}{2}}$$

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

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_1\Gamma_9/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.6340 ± 0.0070 ± 0.0039	1	LEES	13Q	BABR $e^+e^- \rightarrow K^+K^-\gamma$

NODE=M004G01
NODE=M004G01

• • • 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;LINKAGE=A

$$\Gamma(K_L^0 K_S^0) \times \Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_2\Gamma_9/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.4200 ± 0.0033 ± 0.0123	28k	1	LEES	14H BABR $e^+e^- \rightarrow K_S^0 K_L^0 \gamma$

NODE=M004GXX
NODE=M004GXX

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;LINKAGE=A

$$\phi(1020) \Gamma(i) \Gamma(e^+e^-) / \Gamma^2(\text{total})$$

NODE=M004224

$$\Gamma(K^+K^-) / \Gamma_{\text{total}} \times \Gamma(e^+e^-) / \Gamma_{\text{total}} \quad \Gamma_1/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
14.63 ± 0.29 OUR FIT				Error includes scale factor of 1.5.

14.6 ± 0.5 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.

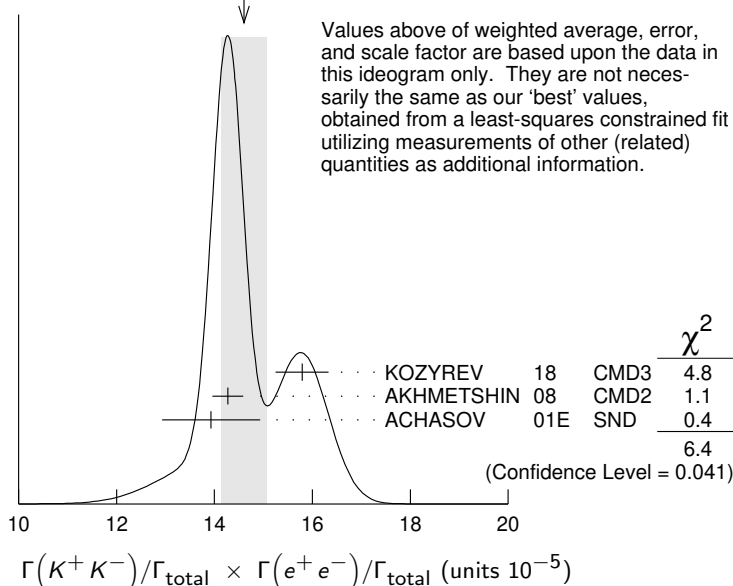
15.789±0.541	1.7M	KOZYREV	18	CMD3	$e^+e^- \rightarrow K^+K^-$
14.27 ±0.05 ±0.31	542k	AKHMETSHIN	08	CMD2	1.02 $e^+e^- \rightarrow K^+K^-$
13.93 ±0.14 ±0.99	1000k	¹ ACHASOV	01E	SND	$e^+e^- \rightarrow K^+K^-$, $K_S K_L, \pi^+\pi^-\pi^0$

NODE=M004G10
NODE=M004G10

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.

NODE=M004G10;LINKAGE=AE

WEIGHTED AVERAGE
14.6 ± 0.5 (Error scaled by 1.8)



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

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
10.10 ±0.12 OUR FIT Error includes scale factor of 1.1.				
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	$e^+ e^- \rightarrow K_S^+ K_L^-, K_S K_L, \pi^+ \pi^- \pi^0$

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.

NODE=M004G6
NODE=M004G6

NODE=M004G6;LINKAGE=A
NODE=M004G;LINKAGE=GS
NODE=M004G6;LINKAGE=AE

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

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

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.53 ±0.10 OUR FIT Error includes scale factor of 1.1.				
4.46 ±0.12 OUR AVERAGE				
4.51 ±0.16 ±0.11	105k	AKHMETSHIN 06	CMD2	$0.98-1.06 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
4.30 ±0.08 ±0.21		AUBERT,B	04N BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$
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	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.38 ±0.12		BENAYOUN	10 RVUE	$0.4-1.05 e^+ e^-$

¹ From the combined fit assuming that the total $\phi(1020)$ production cross section is saturated by those of $K^+ K^-$, $K_S K_L$, $\pi^+ \pi^- \pi^0$, 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.

NODE=M004G7
NODE=M004G7

NODE=M004G7;LINKAGE=AE

NODE=M004G;LINKAGE=B

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

$$\Gamma_6/\Gamma \times \Gamma_9/\Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
3.87 ±0.07 OUR FIT Error includes scale factor of 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 $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = (23.1 \pm 0.5) \times 10^{-2}$.

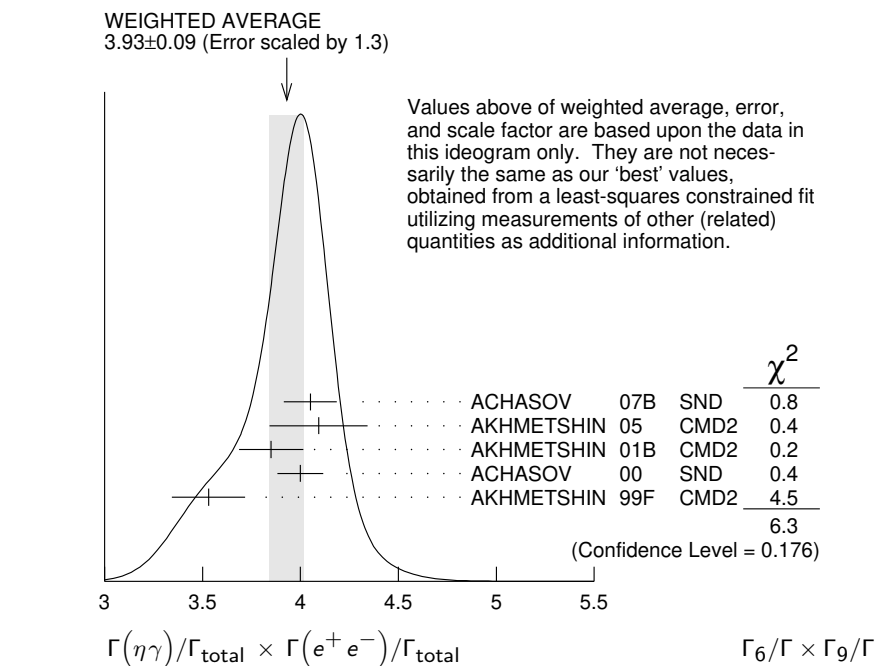
⁸ A simultaneous fit of $e^+ e^- \rightarrow \pi^+ \pi^-, \pi^+ \pi^- \pi^0, \pi^0 \gamma, \eta\gamma$ data.

NODE=M004G2
NODE=M004G2

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



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

$\Gamma_7/\Gamma \times \Gamma_9/\Gamma$

NODE=M004G3
NODE=M004G3

VALUE (units 10^{-7}) EVTS DOCUMENT ID TECN COMMENT

3.88±0.14 OUR FIT

3.87±0.15 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 $e^+e^- \rightarrow \pi^0\gamma$
3.67±0.10 ^{+0.27} _{-0.25}	2	ACHASOV	00	SND	$e^+e^- \rightarrow \pi^0\gamma$

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

4.29±0.11 ³ BENAYOUN 10 RVUE 0.4–1.05 e^+e^-

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 From the $\pi^0 \rightarrow 2\gamma$ decay and using $B(\pi^0 \rightarrow 2\gamma) = (98.798 \pm 0.032) \times 10^{-2}$.

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

NODE=M004G3;LINKAGE=B

NODE=M004G3;LINKAGE=A
NODE=M004G3;LINKAGE=BE

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

$\Gamma_{10}/\Gamma \times \Gamma_9/\Gamma$

NODE=M004G5
NODE=M004G5

8.5^{+0.5}_{-0.6} OUR FIT

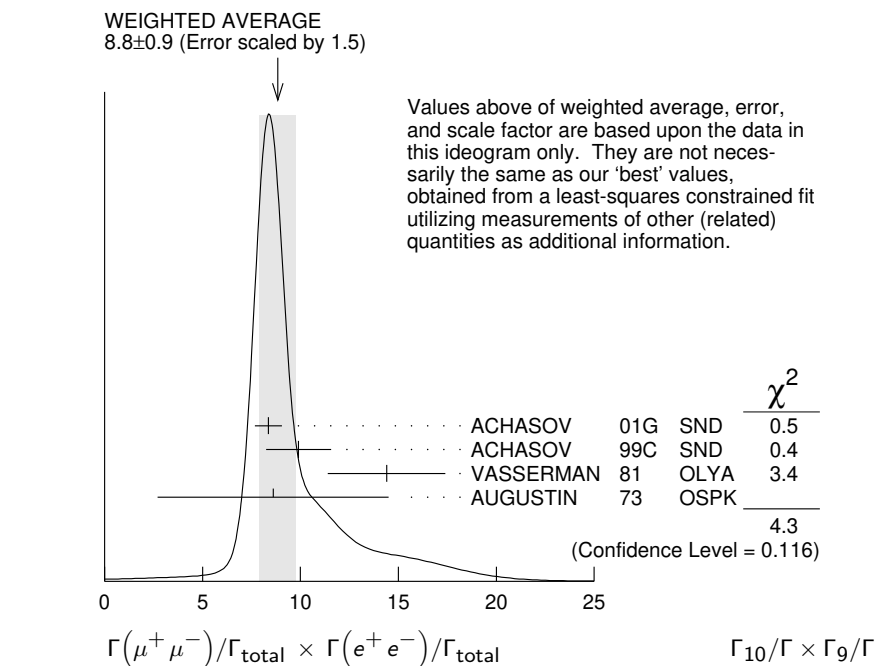
8.8 ±0.9 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

8.36±0.59±0.37		ACHASOV	01G	SND	$e^+e^- \rightarrow \mu^+\mu^-$
9.9 ±1.4 ±0.9	1	ACHASOV	99C	SND	$e^+e^- \rightarrow \mu^+\mu^-$
14.4 ±3.0	2	VASSERMAN	81	OLYA	$e^+e^- \rightarrow \mu^+\mu^-$
8.6 ±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.

NODE=M004G5;LINKAGE=A
NODE=M004G5;LINKAGE=B



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

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

2.2 ± 0.4 OUR FIT

2.2 ± 0.4 OUR AVERAGE

2.1 ± 0.3 ± 0.3 ¹ ACHASOV 00c SND $e^+e^- \rightarrow \pi^+\pi^-$

1.95^{+1.15}_{-0.87} ² GOLUBEV 86 ND $e^+e^- \rightarrow \pi^+\pi^-$

6.01^{+3.19}_{-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 ± 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.

NODE=M004G4
NODE=M004G4

NODE=M004G4;LINKAGE=AC
NODE=M004G4;LINKAGE=B
NODE=M004G4;LINKAGE=A

$$\Gamma(\omega\pi^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma \times \Gamma_9/\Gamma$$

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

1.40 ± 0.15 OUR FIT

1.37 ± 0.17 ± 0.01 ^{1,2} AMBROSINO 08G KLOE $e^+e^- \rightarrow \pi^+\pi^-2\pi^0, 2\pi^0\gamma$

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 $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M004G11
NODE=M004G11

NODE=M004G11;LINKAGE=AB
NODE=M004G11;LINKAGE=AM

$$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_9/\Gamma$$

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

$$\Gamma(\pi^+\pi^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma \times \Gamma_9/\Gamma$$

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

NODE=M004220

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.492±0.005 OUR FIT	Error includes scale factor of 1.3.			
0.493±0.010 OUR AVERAGE				
0.492±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	$2.1-2.7 K^-p \rightarrow \Lambda K^+K^-$

NODE=M004R1
NODE=M004R1

• • • 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=M004R1;LINKAGE=AK

NODE=M004R1;LINKAGE=B2

 $\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.340±0.004 OUR FIT	Error includes scale factor of 1.3.			
0.331±0.009 OUR AVERAGE				
0.335±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	$e^+e^- \rightarrow K_L^0 K_S^0$

NODE=M004R2
NODE=M004R2

• • • 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;LINKAGE=AK

NODE=M004R2;LINKAGE=B2

NODE=M004R2;LINKAGE=01

 $\Gamma(K_L^0 K_S^0)/\Gamma(K^+K^-)$ Γ_2/Γ_1

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.690±0.015 OUR FIT	Error includes scale factor of 1.3.			
0.740±0.031 OUR AVERAGE				
0.70 ±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	$3.9, 4.6 K^-p$

NODE=M004R19
NODE=M004R19

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

0.638±0.022	2.3M	¹ KOZYREV 18	CMD3	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$
0.68 ±0.03		² AKHMETSHIN 95	CMD2	$e^+e^- \rightarrow K_L^0 K_S^0, K^+K^-$

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 DUBYSKIY 07. BENAYOUN 12 obtains 0.71 ± 0.01 in the HLS model.

NODE=M004R19;LINKAGE=A

NODE=M004R19;LINKAGE=KH

$$\Gamma(K_L^0 K_S^0)/\Gamma(K\bar{K})$$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.408±0.005 OUR FIT	Error includes scale factor of 1.3.			
0.45 ±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.

NODE=M004R5
NODE=M004R5

NODE=M004R5;LINKAGE=01

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma_{\text{total}}$$

$$\Gamma_3/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1524±0.0033 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.

NODE=M004R3
NODE=M004R3

NODE=M004R3;LINKAGE=AK

NODE=M004R3;LINKAGE=B2

NODE=M004R;LINKAGE=8D

NODE=M004R3;LINKAGE=E

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K^+ K^-)$$

$$\Gamma_3/\Gamma_1$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.310±0.009 OUR FIT	Error includes scale factor of 1.2.			
0.28 ±0.09	34	AGUILAR-...	72B HBC	3.9,4.6 $K^- p$

NODE=M004R20
NODE=M004R20

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K\bar{K})$$

$$\Gamma_3/(\Gamma_1+\Gamma_2)$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.183±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 $K^- p \rightarrow \Lambda \pi^+ \pi^- \pi^0$

NODE=M004R6
NODE=M004R6

$$[\Gamma(\rho\pi) + \Gamma(\pi^+ \pi^- \pi^0)]/\Gamma(K_L^0 K_S^0)$$

$$\Gamma_3/\Gamma_2$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.448±0.011 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	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$

NODE=M004R7
NODE=M004R7

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

$$\Gamma_5/\Gamma$$

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=M004R46
NODE=M004R46

NODE=M004R;LINKAGE=L1

NODE=M004R;LINKAGE=L2

NODE=M004R;LINKAGE=46

$\Gamma(\eta\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

NODE=M004R11
 NODE=M004R11

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

1.303 $\pm$ 0.025 OUR FIT Error includes scale factor of 1.2.

1.26 $\pm$ 0.04 OUR AVERAGE

1.246 $\pm$ 0.025 $\pm$ 0.057	10k	¹ ACHASOV	98F	SND	$e^+e^- \rightarrow 7\gamma$
1.18 $\pm$ 0.11	279	² AKHMETSHIN	95	CMD2	$e^+e^- \rightarrow \pi^+\pi^-3\gamma$
1.30 $\pm$ 0.06		³ DRUZHININ	84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 $\pm$ 0.2		⁴ DRUZHININ	84	ND	$e^+e^- \rightarrow 6\gamma$
0.88 $\pm$ 0.20	290	KURDADZE	83C	OLYA	$e^+e^- \rightarrow 3\gamma$
1.35 $\pm$ 0.29		ANDREWS	77	CNTR	6.7-10 γ Cu
1.5 $\pm$ 0.4	54	³ COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.38 $\pm$ 0.02 $\pm$ 0.02		⁵ AKHMETSHIN	11	CMD2	1.02 $e^+e^- \rightarrow \eta\gamma$
1.36 $\pm$ 0.05 $\pm$ 0.02	33k	⁶ ACHASOV	07B	SND	0.6-1.38 $e^+e^- \rightarrow \eta\gamma$
1.373 $\pm$ 0.014 $\pm$ 0.085	17.4k	^{7,8} AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \rightarrow \eta\gamma$
1.287 $\pm$ 0.013 $\pm$ 0.063		^{9,10} AKHMETSHIN	01B	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.338 $\pm$ 0.012 $\pm$ 0.052		¹¹ ACHASOV	00	SND	$e^+e^- \rightarrow \eta\gamma$
1.18 $\pm$ 0.03 $\pm$ 0.06	2200	¹² AKHMETSHIN	99F	CMD2	$e^+e^- \rightarrow \eta\gamma$
1.21 $\pm$ 0.07		¹³ BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \rightarrow \eta\gamma$

OCCUR=2

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 $B(\phi(1020) \rightarrow e^+e^-) = (2.973 \pm 0.034) \times 10^{-4}$. 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;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_7/Γ

NODE=M004R17
 NODE=M004R17

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

1.30 $\pm$ 0.05 OUR FIT

1.31 $\pm$ 0.13 OUR AVERAGE

1.30 $\pm$ 0.13		DRUZHININ	84	ND	$e^+e^- \rightarrow 3\gamma$
1.4 $\pm$ 0.5	32	COSME	76	OSPK	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.367 $\pm$ 0.072		¹ ACHASOV	16A	SND	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
1.258 $\pm$ 0.037 $\pm$ 0.077	18k	^{2,3} AKHMETSHIN	05	CMD2	0.60-1.38 $e^+e^- \rightarrow \pi^0\gamma$
1.226 $\pm$ 0.036 $^{+0.096}_{-0.089}$		⁴ ACHASOV	00	SND	$e^+e^- \rightarrow \pi^0\gamma$
1.26 $\pm$ 0.17		⁵ BENAYOUN	96	RVUE	0.54-1.04 $e^+e^- \rightarrow \pi^0\gamma$

OCCUR=3

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.

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_6/Γ_7

NODE=M004R42
 NODE=M004R42

VALUE DOCUMENT ID TECN COMMENT

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

10.9 $\pm$ 0.3 $^{+0.7}_{-0.8}$ ACHASOV 00 SND $e^+e^- \rightarrow \eta\gamma, \pi^0\gamma$

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.973±0.034 OUR FIT	Error includes scale factor of 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	$e^+e^- \rightarrow \text{hadrons}$
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

NODE=M004R16;LINKAGE=AE

NODE=M004R16;LINKAGE=E

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

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.86±0.19 OUR 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

NODE=M004R10;LINKAGE=A
NODE=M004R;LINKAGE=GZ
NODE=M004R10;LINKAGE=8D
NODE=M004R;LINKAGE=VA

 $\Gamma(\eta e^+e^-)/\Gamma_{\text{total}}$ Γ_{11}/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 $B(\pi^0 \rightarrow \gamma\gamma) = (98.798 \pm 0.033) \times 10^{-2}$, $B(\pi^0 \rightarrow e^+e^-) = (1.198 \pm 0.032) \times 10^{-2}$, $B(\eta \rightarrow \pi^+\pi^-\pi^0) = (23.0 \pm 0.4) \times 10^{-2}$, $B(\phi \rightarrow \pi^+\pi^-\pi^0) = (15.5 \pm 0.6) \times 10^{-2}$, 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_{12}/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_{13}/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_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.05 84 LINDSEY 66 HBC $2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^-$ neutrals

NODE=M004R14
NODE=M004R14

 $\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{15}/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	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^-$ neutrals

¹ Supersedes AKHMETSHIN 97C.

NODE=M004R15
NODE=M004R15

NODE=M004R;LINKAGE=1N

 $\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ Γ_{16}/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	$2.1-2.7 K^-p \rightarrow \Lambda\pi^+\pi^-$ 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_{17}/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_{17}/Γ_6

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

2.47^{+0.15}_{-0.16} 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;LINKAGE=AI

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

 Γ_{18}/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_{18}/Γ_6

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_{19}/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_{20}/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_{21}/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_{22}/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	$e^+e^- \rightarrow \eta\pi^0\gamma$

OCCUR=2

• • • 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	$e^+e^- \rightarrow \pi^0\eta\gamma$

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.

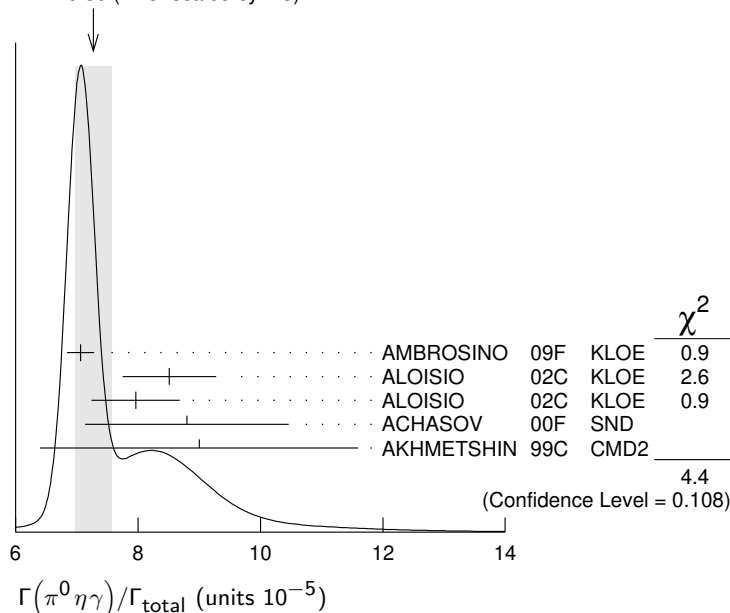
⁵ Using $B(\phi \rightarrow \eta\gamma) = (1.304 \pm 0.025)\%$, $B(\eta \rightarrow 3\pi^0) = (32.56 \pm 0.23)\%$, and $B(\eta \rightarrow \gamma\gamma) = (39.31 \pm 0.20)\%$.

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
$<1.9 \times 10^{-8}$	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
6.22 ± 0.21 OUR FIT					
6.22 ± 0.30 OUR AVERAGE					
$6.22 \pm 0.27 \pm 0.12$		3407	¹ AMBROSINO	07A KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
$6.7^{+2.8}_{-2.4} \pm 0.8$		12	² AULCHENKO	03B SND	$e^+e^- \rightarrow \eta'\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$6.7^{+5.0}_{-4.2} \pm 1.5$		7	AULCHENKO	03B SND	$e^+e^- \rightarrow 7\gamma$
$6.10 \pm 0.61 \pm 0.43$		120	³ ALOISIO	02E KLOE	$1.02 e^+e^- \rightarrow \pi^+\pi^-\gamma$
$8.2^{+2.1}_{-1.9} \pm 1.1$		21	⁴ AKHMETSHIN	00B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
$4.9^{+2.2}_{-1.8} \pm 0.6$		9	⁵ AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \pi^+\pi^-\pi^+\pi^- \geq 2\gamma$
6.4 ± 1.6		30	⁶ AKHMETSHIN	00F CMD2	$e^+e^- \rightarrow \eta'(958)\gamma$
$6.7^{+3.4}_{-2.9} \pm 1.0$		5	⁷ AULCHENKO	99 SND	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<11		90	AULCHENKO	98 SND	$e^+e^- \rightarrow 7\gamma$
$12^{+7}_{-5} \pm 2$		6	⁴ AKHMETSHIN	97B CMD2	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
<41		90	DRUZHININ	87 ND	$e^+e^- \rightarrow \gamma\eta\pi^+\pi^-$

NODE=M004R25
NODE=M004R25

OCCUR=2

OCCUR=2

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 $B(\phi(1020) \rightarrow \eta\gamma) = (1.303 \pm 0.025) \times 10^{-2}$. 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;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				
$1.46^{+0.64}_{-0.54} \pm 0.18$	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_{25}/Γ_6 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_{26}/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_{27}/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_{28}/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_{29}/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_{30}/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_{31}/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_{32}/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_{33}/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

ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
AAIJ 19H	JHEP 1904 063	R. Aaij <i>et al.</i>	(LHCb Collab.)
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.			

NODE=M004

REFID=60439
REFID=59670
REFID=58971
REFID=59987
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REFID=53212
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REFID=53105
REFID=52572
REFID=52573
REFID=52268

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
DUBYSKIY	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
ACHASOV	02	Translated from ZETF 124 28. 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
ALOISIO	02C	Translated from ZETFP 75 539. 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
ACHASOV	00C	Translated from ZETF 117 22. 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
ACHASOV	00E	Translated from ZETFP 72 411. 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
BRAMON	00	Translated from ZETF 117 1067. 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
ACHASOV	98B	Translated from ZETFP 69 87. 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
DOLINSKY	88	Translated from YAF 47 393. SJNP 48 277	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41022
DRUZHININ	87	Translated from YAF 48 442. 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
ALBRECHT	85D	Translated from YAF 44 633. 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
DRUZHININ	84	Translated from YAF 41 1183. 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
ARENTON	82	Translated from ZETFP 38 306. 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
Also		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
		Translated from YAF 27 985			
BUKIN	78C	SJNP 27 516	A.D. Bukin <i>et al.</i>	(NOVO)	REFID=20544
		Translated from YAF 27 976			
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

h₁(1170)

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

h₁(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	0 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.

h₁(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	0 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.

h₁(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
REFID=20232
REFID=20529
REFID=20531
REFID=20532
REFID=20533
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 **$b_1(1235)$**

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

NODE=M011

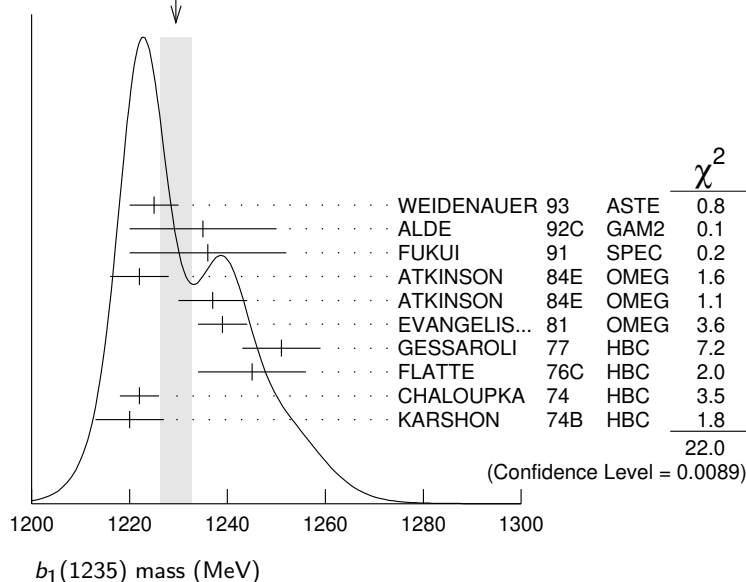
 $b_1(1235)$ MASS

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	0 $20-70 \gamma p$
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 ± 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

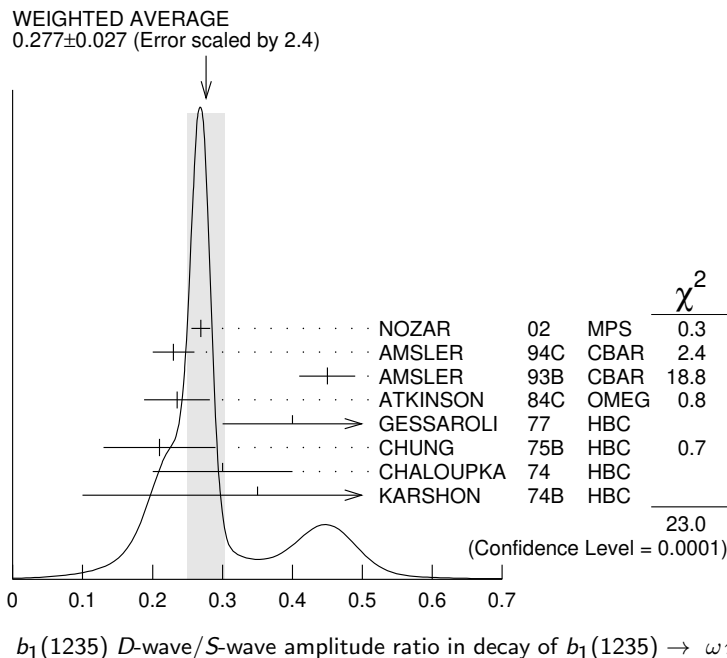
$\Gamma(\pi^\pm \gamma)$	DOCUMENT ID	TECN	CHG	COMMENT	Γ_2
VALUE (keV)					
230 ± 60	COLLICK	84	SPEC	— $200 \pi^+ Z \rightarrow Z \pi \omega$	

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

$\Gamma(\eta\rho)/\Gamma(\omega\pi)$

Γ_3/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.10	ATKINSON	84D	OMEG	20–70 γp

NODE=M011R9
NODE=M011R9

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

Γ_4/Γ_1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
<0.5	ABOLINS	63	HBC	+ 3.5 $\pi^+ p$

NODE=M011R1
NODE=M011R1

$\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$

Γ_5/Γ

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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

$\Gamma((K\bar{K})^\pm \pi^0)/\Gamma(\omega\pi)$

Γ_6/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.08	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$

NODE=M011R6
NODE=M011R6

$\Gamma(K_S^0 K_L^0 \pi^\pm)/\Gamma(\omega\pi)$

Γ_7/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.06	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$

NODE=M011R8
NODE=M011R8

$\Gamma(K_S^0 K_S^0 \pi^\pm)/\Gamma(\omega\pi)$

Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<0.02	90	BALTAY	67	HBC	± 0.0 $\bar{p} p$

NODE=M011R7
NODE=M011R7

$\Gamma(\phi\pi)/\Gamma(\omega\pi)$

Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT
<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.)
NOZAR	02	PL B541 35	M. Nozar <i>et al.</i>	
VIKTOROV	96	PAN 59 1184	V.A. Viktorov <i>et al.</i>	(SERP)
		Translated from YAF 59 1239.		
AMSLER	94C	PL B327 425	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AMSLER	93B	PL B311 362	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
WEIDENAUER	93	ZPHY C59 387	P. Weidenauer <i>et al.</i>	(ASTERIX Collab.)
ALDE	92C	ZPHY C54 553	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)
ATKINSON	84C	NP B243 1	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+) JP
ATKINSON	84D	NP B242 269	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
ATKINSON	84E	PL 138B 459	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
COLLICK	84	PRL 53 2374	B. Collick <i>et al.</i>	(MINN, ROCH, FNAL)
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
BALTAY	78B	PR D17 62	C. Baltay <i>et al.</i>	(COLU, BING)
GESSAROLI	77	NP B126 382	R. Gessaroli <i>et al.</i>	(BGNA, FIRZ, GENO+) JP
FLATTE	76C	PL 64B 225	S.M. Flatte <i>et al.</i>	(CERN, AMST, NIJ+) JP
CHUNG	75B	PR D11 2426	S.U. Chung <i>et al.</i>	(BNL, LBL, UCSC) JP
CHALOUPKA	74	PL 51B 407	V. Chaloupka <i>et al.</i>	(CERN) JP
KARSHON	74B	PR D10 3608	U. Karshon <i>et al.</i>	(REHO) JP
BIZZARRI	69	NP B14 169	R. Bizzarri <i>et al.</i>	(CERN, CDEF)
BALTAY	67	PRL 18 93	C. Baltay <i>et al.</i>	(COLU)
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL)
ABOLINS	63	PRL 11 381	M.A. Abolins <i>et al.</i>	(UCSD)

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 $a_1(1260)$

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

See also our review under the $a_1(1260)$ in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M010

NODE=M010

 $a_1(1260)$ MASS

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 ± 1.05 ± 6.33	894k	AAIJ	18A	LHCB $D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
1209 ± 4 +12 -9		² MIKHASENKO	18	RVUE $\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau$
1225 ± 9 ± 20	7k	³ DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1255 ± 6 +7 -17	420k	⁴ ALEKSEEV	10	COMP 190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1243 ± 12 ± 20		⁵ AUBERT	07AU	BABR 10.6 $e^+ e^- \rightarrow \rho^0 \pi^\pm \pi^\mp \gamma$
1230–1270	6360	⁶ LINK	07A	FOCS $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
1203 ± 3		⁷ 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 ± 10 ± 3	37k	⁸ ASNER	00	CLE2 10.6 $e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
1255 ± 7 ± 6	5904	⁹ ABREU	98G	DLPH $e^+ e^-$
1207 ± 5 ± 8	5904	¹⁰ ABREU	98G	DLPH $e^+ e^-$
1196 ± 4 ± 5	5904	^{11,12} ABREU	98G	DLPH $e^+ e^-$
1240 ± 10		BARBERIS	98B	450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
1262 ± 9 ± 7		^{9,13} ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1210 ± 7 ± 2		^{10,13} ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88-94, \tau \rightarrow 3\pi \nu$
1211 ± 7 +50 -0		¹⁰ ALBRECHT	93C	ARG $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1121 ± 8		¹⁴ ANDO	92	SPEC 8 $\pi^- p \rightarrow \pi^+ \pi^- \pi^0 n$
1242 ± 37		¹⁵ IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 14		¹⁶ IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1250 ± 9		¹⁷ IVANOV	91	RVUE $\tau \rightarrow \pi^+ \pi^+ \pi^- \nu$
1208 ± 15		ARMSTRONG	90	OMEG 300.0 $pp \rightarrow p p \pi^+ \pi^- \pi^0$
1220 ± 15		¹⁸ ISGUR	89	RVUE $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$
1260 ± 25		¹⁹ BOWLER	88	RVUE
1166 ± 18 ± 11		BAND	87	MAC $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \nu$

NODE=M010M

NODE=M010M

→ UNCHECKED ←

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

OCCUR=3

1164	± 41	± 23	BAND	87	MAC	$\tau^+ \rightarrow \pi^+ \pi^0 \pi^0 \nu$
1250	± 40		¹⁸ 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		²⁰ DANKOWY...	81	SPEC	$8.45 \pi^- p \rightarrow n 3\pi$
1280	± 30		²⁰ DAUM	81B	CNTR	$63.94 \pi^- p \rightarrow p 3\pi$
1041	± 13		²¹ GAVILLET	77	HBC	$4.2 K^- p \rightarrow \Sigma 3\pi$

OCCUR=2

¹ Statistical error negligible.² From the pole position. Using an amplitude analysis based on approximate three-body unitary of τ data from SCHAEEL 05C.³ Reanalysis of CLEO data using Breit-Wigner parameterization.⁴ Superseded by AGHASYAN 2018B.⁵ The $\rho^\pm \pi^\mp$ state can be also due to the $\pi(1300)$.⁶ Using the Breit-Wigner parameterization; strong correlation between mass and width.⁷ Using the data of BARATE 98R.⁸ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.⁹ Uses the model of KUHN 90.¹⁰ Uses the model of ISGUR 89.¹¹ Includes the effect of a possible a_1' state.¹² Uses the model of FEINDT 90.¹³ Supersedes AKERS 95P.¹⁴ Average and spread of values using 2 variants of the model of BOWLER 75.¹⁵ Reanalysis of RUCKSTUHL 86.¹⁶ Reanalysis of SCHMIDKE 86.¹⁷ Reanalysis of ALBRECHT 86B.¹⁸ From a combined reanalysis of ALBRECHT 86B, SCHMIDKE 86, and RUCKSTUHL 86.¹⁹ From a combined reanalysis of ALBRECHT 86B and DAUM 81B.²⁰ Uses the model of BOWLER 75.²¹ Produced in K^- backward scattering.

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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

NODE=M010W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
250 to 600 OUR ESTIMATE				
420 ± 35 OUR AVERAGE				
380 ± 80	46M	¹ AGHASYAN	18B	COMP $190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
430 $\pm 24 \pm 31$		DARGENT	17	RVUE $D^0 \rightarrow \pi^- \pi^+ \pi^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
422.01 $\pm 2.10 \pm 12.72$	894k	AAIJ	18AI	LHCB $D^0 \rightarrow K^\mp \pi^\pm \pi^\pm \pi^\mp$
576 $\pm 11 \pm 89$		² MIKHASENKO	18	RVUE $\tau^- \rightarrow \pi^- \pi^+ \pi^- \nu_\tau$
367 $\pm 9 \pm 28$	420k	³ ALEKSEEV	10	COMP $190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
410 $\pm 31 \pm 30$		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 $B \rightarrow D(*) K^- K^{*0}$
814 $\pm 36 \pm 13$	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 $1.05\text{--}1.38 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0$
570 ± 10		¹⁰ BONDAR	99	RVUE $e^+ e^- \rightarrow 4\pi, \tau \rightarrow 3\pi \nu_\tau$
587 $\pm 27 \pm 21$	5904	¹¹ ABREU	98G	DLPH $e^+ e^-$
478 $\pm 3 \pm 15$	5904	¹² ABREU	98G	DLPH $e^+ e^-$
425 $\pm 14 \pm 8$	5904	^{13,14} ABREU	98G	DLPH $e^+ e^-$
400 ± 35		BARBERIS	98B	$450 p p \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$
621 $\pm 32 \pm 58$		^{11,15} ACKERSTAFF	97R	OPAL $E_{cm}^{ee} = 88\text{--}94, \tau \rightarrow 3\pi \nu$

NODE=M010W

→ UNCHECKED ←

OCCUR=2

OCCUR=3

457	± 15	± 17	12,15	ACKERSTAFF	97R	OPAL	$E_{\text{cm}}^{\text{ee}} = 88\text{--}94, \tau \rightarrow 3\pi\nu$	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	$300.0 p p \rightarrow p p \pi^+ \pi^- \pi^0$	
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 From the pole position. Using an amplitude analysis based on approximate three-body unitarity of τ data from SCHAEEL 05C.

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.

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$a_1(1260)$ 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 $f_0(980)\pi, f_0 \rightarrow \pi\pi$	not seen
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} $K K \pi$	seen
Γ_{13} $K^*(892) K$	seen
Γ_{14} $\pi \gamma$	seen

DESIG=17;OUR EST;→ UNCHECKED ←
DESIG=7;OUR EST;→ UNCHECKED ←
DESIG=8;OUR EST;→ UNCHECKED ←
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DESIG=14;OUR EST;→ UNCHECKED ←
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$a_1(1260)$ PARTIAL WIDTHS **$\Gamma(\pi\gamma)$** **Γ_{14}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
640 ± 246	ZIELINSKI	84C SPEC	200 $\pi^+ Z \rightarrow Z 3\pi$

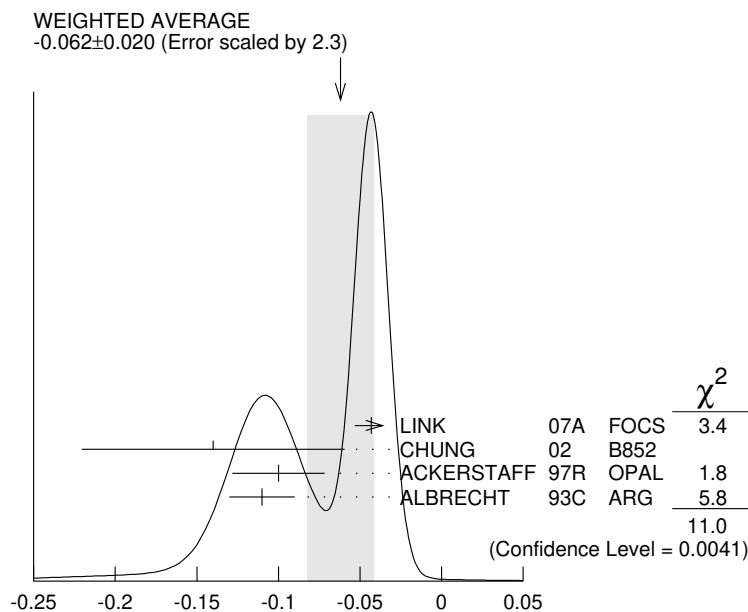
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NODE=M010W4
NODE=M010W4 **D -wave/ S -wave AMPLITUDE RATIO IN DECAY OF $a_1(1260) \rightarrow \rho\pi$**

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	$18.3 \pi^- p \rightarrow \pi^+ \pi^- \pi^- p$
$-0.10 \pm 0.02 \pm 0.02$	^{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
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 **$\Gamma((\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$** **$\Gamma_3 / \Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.30 \pm 0.60 \pm 0.22$	37k	¹ ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R6
NODE=M010R6 **$\Gamma((\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi) / \Gamma_{\text{total}}$** **$\Gamma_4 / \Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.56 \pm 0.84 \pm 0.32$	37k	^{1,2} ASNER	00 CLE2	$10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R7
NODE=M010R7

$\Gamma((\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi)/\Gamma_{\text{total}}$
 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 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R8
NODE=M010R8

 $\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$
 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	^{1,3} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R9
NODE=M010R9

 $\Gamma(f_0(500)\pi, f_0 \rightarrow \pi\pi)/\Gamma((\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi)$
 Γ_6/Γ_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		⁴ LONGACRE	82	RVUE

NODE=M010R4
NODE=M010R4

 $\Gamma(f_0(980)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$
 Γ_7/Γ

VALUE (units 10^{-2})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	37k	ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R10
NODE=M010R10

 $\Gamma(f_0(1370)\pi, f_0 \rightarrow \pi\pi)/\Gamma_{\text{total}}$
 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	^{1,5} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R11
NODE=M010R11

 $\Gamma(f_2(1270)\pi, f_2 \rightarrow \pi\pi)/\Gamma_{\text{total}}$
 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	^{1,6} ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$

NODE=M010R12
NODE=M010R12

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$
 Γ_{10}/Γ

VALUE	DOCUMENT ID	COMMENT
seen	BARBERIS	98B 450 $pp \rightarrow p_f \pi^+ \pi^- \pi^0 p_s$

NODE=M010R00
NODE=M010R00

 $\Gamma(\pi^0 \pi^0 \pi^0)/\Gamma(\pi^+ \pi^- \pi^0)$
 Γ_{11}/Γ_{10}

VALUE	CL%	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 0.008	90	⁷ BARBERIS	01 450 $pp \rightarrow p_f 3\pi^0 p_s$

NODE=M010R15
NODE=M010R15

 $\Gamma(K^*(892)K)/\Gamma_{\text{total}}$
 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	⁸ COAN	04	CLEO $\tau^- \rightarrow K^- \pi^- K^+ \nu_\tau$
8 to 15	205	⁹ DRUTSKOY	02	BELL $B \rightarrow D^{(*)} K^- K^{*0}$
$3.3 \pm 0.5 \pm 0.1$	37k	¹⁰ ASNER	00	CLE2 $10.6 e^+ e^- \rightarrow \tau^+ \tau^-$, $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$
2.6 ± 0.3		¹¹ BARATE	99R	ALEP $\tau \rightarrow K \bar{K} \pi \nu_\tau$

NODE=M010R13
NODE=M010R13

- ¹ From a fit to the Dalitz plot.
- ² Assuming for $\rho(1450)$ mass and width of 1370 and 386 MeV respectively.
- ³ Assuming for $f_0(500)$ (σ) mass and width of 860 and 880 MeV respectively.
- ⁴ Uses multichannel Aitchison-Bowler model (BOWLER 75). Uses data from GAVIL-LET 77, DAUM 80, and DANKOWYCH 81.
- ⁵ Assuming for $f_0(1370)$ mass and width of 1186 and 350 MeV respectively.
- ⁶ Assuming for $f_2(1270)$ mass and width of 1275 and 185 MeV respectively.
- ⁷ Inconsistent with observations of $\sigma\pi$, $f_0(1370)\pi$, and $f_2(1270)\pi$ decay modes.
- ⁸ 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.
- ⁹ From a comparison to ALAM 94 assuming purely resonant production of the $K^- K^{*0}$ system.
- ¹⁰ From a fit to the 3π mass spectrum including the $K\bar{K}^*(892)$ threshold.
- ¹¹ Assuming $a_1(1260)$ dominance and taking $B(\tau^- \rightarrow a_1(1260)\nu_\tau)$ from BUSKULIC 96.

NODE=M010R;LINKAGE=B1

NODE=M010R;LINKAGE=B2

NODE=M010R;LINKAGE=B3

NODE=M010R4;LINKAGE=E

NODE=M010R;LINKAGE=B4

NODE=M010R;LINKAGE=B5

NODE=M010R;LINKAGE=RB

NODE=M010R13;LINKAGE=CO

NODE=M010R;LINKAGE=DR

NODE=M010R;LINKAGE=B6

NODE=M010R13;LINKAGE=BA

$a_1(1260)$ REFERENCES

AAIJ	18AI	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. Mikhayenko <i>et al.</i>	(JPAC Collab.)
DARGENT	17	JHEP 1705 143	P. d'Argent <i>et al.</i>	(HEID, BRIS)
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.)
SCHAEEL	05C	PRPL 421 191	S. Schaeel <i>et al.</i>	(ALEPH 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. Akerstaff <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. Dankowych <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+) JP
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=M010

REFID=59187

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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

 $f_2(1270)$ MASS

NODE=M005M

NODE=M005M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1275.5 ± 0.8 OUR AVERAGE				
1275.8 ± 1.0 ± 0.4		¹ BOGOLYUB...	13 SPEC	$7\pi^+(K^+,p)A \rightarrow n\gamma + X$
1262 ± $\frac{1}{2}$ ± 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	$100\pi^-p \rightarrow \pi^0\pi^0n$
1278 ± 5		³ BERTIN	97c OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$
1272 ± 8	200k	PROKOSHKIN	94 GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$
1269.7 ± 5.2	5730	AUGUSTIN	89 DM2	$e^+e^- \rightarrow 5\pi$
1283 ± 8	400	⁴ ALDE	87 GAM4	$100\pi^-p \rightarrow 4\pi^0n$
1274 ± 5		⁴ AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1283 ± 6		⁵ 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		⁶ CHABAUD	83 ASPK	$17\pi^-p$ polarized
1280 ± 4		⁷ CASON	82 STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$
1281 ± 7	11600	GIDAL	81 MRK2	J/ψ decay
1282 ± 5		⁸ 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		⁴ 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. • • •				
1263.3 ± 0.2 ± 1.5		⁹ ALBRECHT	20 RVUE	$0.9\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$ $\pi^0K^+K^-$
1259 ± 4 ± 4	1.7k	^{10,11} DOBBS	15	$J/\psi \rightarrow \gamma\pi^+\pi^-$
1267 ± 4 ± 3	1.5k	^{10,11} DOBBS	15	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1270 ± 8		¹² ANISOVICH	09 RVUE	$0.0\bar{p}p, \pi N$
1277 ± 6	870	¹³ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0K_S^0$
1251 ± 10		TIKHOMIROV	03 SPEC	$40.0\pi^-C \rightarrow K_S^0K_S^0K_L^0X$
1260 ± 10		¹⁴ ALDE	97 GAM2	$450pp \rightarrow pp\pi^0\pi^0$
1278 ± 6		¹⁴ GRYGOREV	96 SPEC	$40\pi^-N \rightarrow K_S^0K_S^0X$
1262 ± 11		AGUILAR-...	91 EHS	$400pp$
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	$e^+e^- \rightarrow \pi^+\pi^-X$
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	⁴ ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$
1270 ± 10	360	⁴ ARMENISE	68 DBC	$5.1\pi^+n \rightarrow p\pi^0MM$
1268 ± 6		¹⁵ JOHNSON	68 HBC	$3.7-4.2\pi^-p$

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M005M;LINKAGE=B

NODE=M005M;LINKAGE=K

NODE=M005M;LINKAGE=A

NODE=M005M;LINKAGE=T

NODE=M005M;LINKAGE=L

NODE=M005M;LINKAGE=O

NODE=M005M;LINKAGE=P

NODE=M005M;LINKAGE=S

NODE=M005M;LINKAGE=M

NODE=M005M;LINKAGE=C

NODE=M005M;LINKAGE=D

NODE=M005M;LINKAGE=AN

NODE=M005M;LINKAGE=SC

¹ Averaged over six nuclear targets, no statistically significant dependence on target nucleus observed.² Breit-Wigner mass.³ T-matrix pole.⁴ Mass errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁵ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.⁶ From an energy-independent partial-wave analysis.⁷ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.⁸ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.⁹ T-matrix pole, 5 poles, 5 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).¹⁰ Using CLEO-c data but not authored by the CLEO Collaboration.¹¹ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 185$ MeV.¹² 4-poles, 5-channel K matrix fit.¹³ From analysis of L3 data at 91 and 183–209 GeV.

¹⁴ Systematic uncertainties not estimated.¹⁵ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.

NODE=M005M;LINKAGE=QQ

NODE=M005M;LINKAGE=J

 $f_2(1270)$ WIDTH

NODE=M005W

NODE=M005W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

186.7^{+2.2}_{-2.5} OUR FIT Error includes scale factor of 1.4.**185.9^{+2.8}_{-2.1} OUR AVERAGE** Error includes scale factor of 1.6. See the ideogram below.

190.3 $\pm$ 1.9 $\pm$ 1.8		¹ BOGOLYUB...	13	SPEC	$7\pi^+(K^+,p)A \rightarrow n\gamma + X$	
175 $\pm$ 6 $\pm$ 10		² ABLIKIM	06v	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$	
190 $\pm$ 20		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$	
171 $\pm$ 10		ALDE	98	GAM4	$100\pi^-p \rightarrow \pi^0\pi^0n$	
204 $\pm$ 20		³ BERTIN	97c	OBLX	$0.0\bar{p}p \rightarrow \pi^+\pi^-\pi^0$	
192 $\pm$ 5	200k	PROKOSHKIN	94	GAM2	$38\pi^-p \rightarrow \pi^0\pi^0n$	
180 $\pm$ 24		AGUILAR...	91	EHS	$400pp$	
169 $\pm$ 9	5730	⁴ AUGUSTIN	89	DM2	$e^+e^- \rightarrow 5\pi$	
150 $\pm$ 30	400	⁴ ALDE	87	GAM4	$100\pi^-p \rightarrow 4\pi^0n$	
186 $\pm$ 9 $\pm$ 2		⁵ LONGACRE	86	MPS	$22\pi^-p \rightarrow n2K_S^0$	
179.2 $\pm$ 6.9 $\pm$ 6.6		⁶ CHABAUD	83	ASPK	$17\pi^-p$ polarized	
160 $\pm$ 11		DENNEY	83	LASS	$10\pi^+N$	
196 $\pm$ 10	3k	APEL	82	CNTR	$25\pi^-p \rightarrow n2\pi^0$	
152 $\pm$ 9		⁷ CASON	82	STRC	$8\pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$	
186 $\pm$ 27	11600	GIDAL	81	MRK2	J/ψ decay	
216 $\pm$ 13		⁸ CORDEN	79	OMEG	$12-15\pi^-p \rightarrow n2\pi$	
190 $\pm$ 10	10k	APEL	75	NICE	$40\pi^-p \rightarrow n2\pi^0$	
192 $\pm$ 16	4600	ENGLER	74	DBC	$6\pi^+n \rightarrow \pi^+\pi^-p$	
183 $\pm$ 15	5300	FLATTE	71	HBC	$7\pi^+p \rightarrow \Delta^{++}f_2$	
196 $\pm$ 30		⁴ STUNTEBECK	70	HBC	$8\pi^-p, 5.4\pi^+d$	
216 $\pm$ 20	1960	⁴ ARMENISE	68	DBC	$5.1\pi^+n \rightarrow p\pi^+MM^-$	
128 $\pm$ 27		⁴ BOESEBECK	68	HBC	$8\pi^+p$	
176 $\pm$ 21		^{4,9} JOHNSON	68	HBC	$3.7-4.2\pi^-p$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●						
193.7 $\pm$ 0.4 $\pm$ 1.6		¹⁰ ALBRECHT	20	RVUE	$0.9\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta,$ $\pi^0K^+K^-$	
194 $\pm$ 36		¹¹ ANISOVICH	09	RVUE	$0.0\bar{p}p, \pi N$	
195 $\pm$ 15	870	¹² SCHEGELSKY	06A	RVUE	$\gamma\gamma \rightarrow K_S^0K_S^0$	
121 $\pm$ 26		TIKHOMIROV	03	SPEC	$40.0\pi^-C \rightarrow K_S^0K_S^0K_L^0X$	
187 $\pm$ 20		¹³ ALDE	97	GAM2	$450pp \rightarrow pp\pi^0\pi^0$	
184 $\pm$ 10		¹³ GRYGOREV	96	SPEC	$40\pi^-N \rightarrow K_S^0K_S^0X$	
200 $\pm$ 10		AKER	91	CBAR	$0.0\bar{p}p \rightarrow 3\pi^0$	
240 $\pm$ 40	3k	BINON	83	GAM2	$38\pi^-p \rightarrow n2\eta$	
187 $\pm$ 30	650	⁴ ANTIPOV	77	CIBS	$25\pi^-p \rightarrow p3\pi$	
225 $\pm$ 38	16000	DEUTSCH...	76	HBC	$16\pi^+p$	
166 $\pm$ 28	600	⁴ TAKAHASHI	72	HBC	$8\pi^-p \rightarrow n2\pi$	
173 $\pm$ 53		⁴ 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 width³ T-matrix pole.⁴ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.⁵ From a partial-wave analysis of data using a K-matrix formalism with 5 poles.⁶ From an energy-independent partial-wave analysis.⁷ From an amplitude analysis of the reaction $\pi^+\pi^- \rightarrow 2\pi^0$.⁸ From an amplitude analysis of $\pi^+\pi^- \rightarrow \pi^+\pi^-$ scattering data.⁹ JOHNSON 68 includes BONDAR 63, LEE 64, DERADO 65, EISNER 67.¹⁰ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).¹¹ 4-poles, 5-channel K matrix fit.¹² From analysis of L3 data at 91 and 183–209 GeV.¹³ Systematic uncertainties not estimated.

NODE=M005W;LINKAGE=C

NODE=M005W;LINKAGE=D

NODE=M005W;LINKAGE=QA

NODE=M005W;LINKAGE=T

NODE=M005W;LINKAGE=L

NODE=M005W;LINKAGE=R

NODE=M005W;LINKAGE=Q

NODE=M005W;LINKAGE=U

NODE=M005W;LINKAGE=J

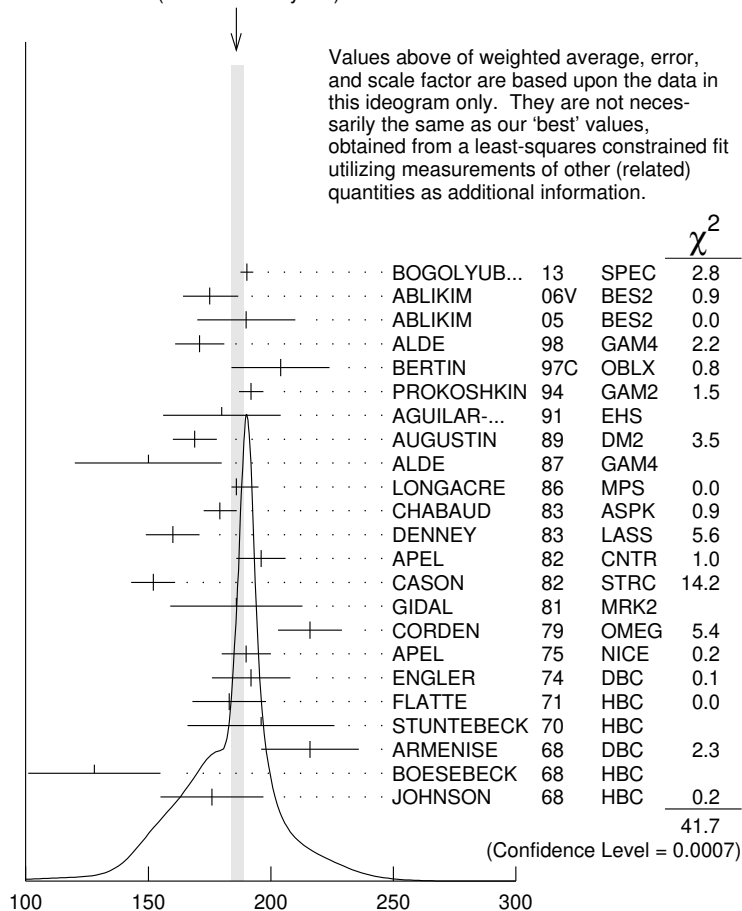
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NODE=M005W;LINKAGE=AN

NODE=M005W;LINKAGE=SC

NODE=M005W;LINKAGE=QQ

WEIGHTED AVERAGE
185.9+2.8-2.1 (Error scaled by 1.6)



$f_2(1270)$ width (MeV)

$f_2(1270)$ DECAY MODES

NODE=M005215;NODE=M005

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \pi\pi$	$(84.2^{+2.9}_{-0.9})\%$	S=1.1
$\Gamma_2 \quad \pi^+\pi^-2\pi^0$	$(7.7^{+1.1}_{-3.2})\%$	S=1.2
$\Gamma_3 \quad K\bar{K}$	$(4.6^{+0.5}_{-0.4})\%$	S=2.7
$\Gamma_4 \quad 2\pi^+2\pi^-$	$(2.8 \pm 0.4)\%$	S=1.2
$\Gamma_5 \quad \eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	S=2.1
$\Gamma_6 \quad 4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$	
$\Gamma_7 \quad \gamma\gamma$	$(1.42 \pm 0.24) \times 10^{-5}$	S=1.4
$\Gamma_8 \quad \eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%
$\Gamma_9 \quad K^0 K^- \pi^+ + \text{c.c.}$	$< 3.4 \times 10^{-3}$	CL=95%
$\Gamma_{10} \quad e^+e^-$	$< 6 \times 10^{-10}$	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 45 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 83.0$ for 38 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	−90						
x_3	10	−39					
x_4	10	−38	1				
x_5	1	−6	0	0			
x_6	0	−7	0	0	0		
x_7	3	1	−15	0	0	0	
Γ	−71	65	−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 $^{+4.0}_{-1.1}$	
Γ_2 $\pi^+\pi^-2\pi^0$	14.4 $^{+2.1}_{-6.0}$	1.2
Γ_3 $K\bar{K}$	8.5 ± 0.8	2.8
Γ_4 $2\pi^+2\pi^-$	5.2 ± 0.7	1.2
Γ_5 $\eta\eta$	0.75 ± 0.14	2.1
Γ_6 $4\pi^0$	0.56 ± 0.19	
Γ_7 $\gamma\gamma$	0.0026 ± 0.0005	1.4

$f_2(1270)$ PARTIAL WIDTHS

NODE=M005220

$\Gamma(\pi\pi)$

 Γ_1

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W1
NODE=M005W1

157.2 $^{+4.0}_{-1.1}$ OUR FIT

157.0 $^{+6.0}_{-1.0}$ ¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

152 ± 8 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(K\bar{K})$

 Γ_3

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W4
NODE=M005W4

8.5 ± 0.8 OUR FIT Error includes scale factor of 2.8.

9.0 $^{+0.7}_{-0.3}$ ¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

7.5 ± 2.0 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\eta\eta)$

 Γ_5

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W7
NODE=M005W7

0.75 ± 0.14 OUR FIT Error includes scale factor of 2.1.

1.0 ± 0.1 ¹ LONGACRE 86 MPS 22 $\pi^- p \rightarrow n 2K_S^0$

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

1.8 ± 0.4 870 ² SCHEGELSKY 06A RVUE $\gamma\gamma \rightarrow K_S^0 K_S^0$

$\Gamma(\gamma\gamma)$

 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).

NODE=M005W8
NODE=M005W8

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M005W8

2.6 ± 0.5 OUR FIT Error includes scale factor of 1.4.

2.93 ± 0.40 ³ DAI 14A RVUE Compilation

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

3.14±0.20		4,5	PENNINGTON 08	RVUE	Compilation
3.82±0.30		5,6	PENNINGTON 08	RVUE	Compilation
2.55±0.15	870	2	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		7	YABUKI 95	VNS	
2.58±0.13 ^{+0.36} _{-0.27}		8	BEHREND 92	CELL	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^-$
3.10±0.35±0.35		9	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		10	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		11	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		12	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		13	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		14	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		15	BERGER 80B	PLUT	$e^+ e^-$

OCCUR=2

OCCUR=3

OCCUR=2

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

Γ_{10}

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.11	90	ACHASOV	00K SND	$e^+ e^- \rightarrow \pi^0 \pi^0$

NODE=M005W9

NODE=M005W9

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

<1.7	90	VOROBYEV 88	ND	$e^+ e^- \rightarrow \pi^0 \pi^0$

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.

³ 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.

⁴ Solution A (preferred solution based on χ^2 -analysis).

⁵ Dispersion theory based amplitude analysis of BOYER 90, MARSISKE 90, BEHREND 92, and MORI 07.

⁶ Solution B (worse than solution A; still acceptable when systematic uncertainties are included).

⁷ With a narrow scalar state around 1220 MeV.

⁸ Using a unitarized model with a 300 - 500 keV wide scalar at 1100 MeV.

⁹ Using the unitarized model of LYTH 85.

¹⁰ 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.

¹¹ Radiative corrections modify the partial widths; for instance the COURAU 84 value becomes 2.66 ± 0.21 in the calculation of LANDRO 86.

¹² Using the MENNESSIER 83 model.

¹³ Superseded by BOYER 90.

¹⁴ If helicity = 2 assumption is not made.

¹⁵ Using mass, width and $B(f_2(1270) \rightarrow 2\pi)$ from PDG 78.

NODE=M005PW;LINKAGE=L
NODE=M005W1;LINKAGE=SC
NODE=M005W8;LINKAGE=A

NODE=M005W8;LINKAGE=P1
NODE=M005W8;LINKAGE=P3

NODE=M005W8;LINKAGE=P2

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

$f_2(1270) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

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	$e^+ e^- \rightarrow e^+ e^- K^+ K^-$

NODE=M005G1

NODE=M005G1

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

0.104±0.007±0.072	² ALBRECHT 90G	ARG	$e^+ e^- \rightarrow e^+ e^- K^+ K^-$

OCCUR=2

¹ Using an incoherent background.

² Using a coherent background.

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
$3.7 \pm 0.3^{+15.9}_{-2.9}$	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	Compilation
13	^{2,3} PENNINGTON 08	RVUE	Compilation
26	^{3,4} PENNINGTON 08	RVUE	Compilation

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.

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

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$
 Γ_1/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

$0.842^{+0.029}_{-0.009}$ OUR FIT Error includes scale factor of 1.1.

0.837 ± 0.020 OUR AVERAGE

0.849 ± 0.025		CHABAUD	83 ASPK	17 $\pi^- p$ polarized
0.85 ± 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. • • •

$0.856 \pm 0.001 \pm 0.05$		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=M005225

NODE=M005R10
NODE=M005R10

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

$0.091^{+0.014}_{-0.040}$ OUR FIT Error includes scale factor of 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 $\pi^+ n \rightarrow p f_2$

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$
 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

$0.033 \pm 0.001 \pm 0.005$	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	$8 \pi^+ p \rightarrow K^+ K^- \pi^+ p$

ERROR=8

 $\Gamma(2\pi^+ 2\pi^-)/\Gamma(\pi\pi)$ 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	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	$1.26 \pi^- p \rightarrow \pi^+ \pi^- n$

NODE=M005R1
NODE=M005R1

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ 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		⁵ ALBRECHT	20	RVUE	$0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$

⁵Residue 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

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=M005R;LINKAGE=BG

NODE=M005R3;LINKAGE=D

NODE=M005R3;LINKAGE=F

NODE=M005R3;LINKAGE=M

 $f_2(1270)$ REFERENCES

NODE=M005

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
DAI	14A	PR D90 036004	L.-Y. Dai, M.R. Pennington	(CEBAF)
BOGOLYUB...	13	PAN 76 1324	M.Yu. Bogolyubsky <i>et al.</i>	(HYPERON-M Collab.)
Translated from YAF 76 1389.				
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	
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
PDG	08	PL B667 1	C. Amsler <i>et al.</i>	(PDG Collab.)
PENNINGTON	08	EPJ C56 1	M.R. Pennington <i>et al.</i>	
UEHARA	08A	PR D78 052004	S. Uehara <i>et al.</i>	(BELLE Collab.)
MORI	07	PR D75 051101	T. Mori <i>et al.</i>	(BELLE Collab.)
ABLIKIM	06V	PL B642 441	M. Ablikim <i>et al.</i>	(BES Collab.)
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <i>et al.</i>	
ABLIKIM	05	PL B607 243	M. Ablikim <i>et al.</i>	(BES Collab.)
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
Translated from YAF 68 998.				
ABLIKIM	04E	PL B603 138	M. Ablikim <i>et al.</i>	(BES Collab.)
BARGIOTTI	03	EPJ C26 371	M. Bargiotti <i>et al.</i>	(OBELIX Collab.)
TIKHOMIROV	03	PAN 66 828	G.D. Tikhomirov <i>et al.</i>	
Translated from YAF 66 860.				
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00E	PL B479 59	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BOGLIONE	99	EPJ C9 11	M. Boglione, M.R. Pennington	
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.				
ALDE	97	PL B397 350	D.M. Alde <i>et al.</i>	(GAMS Collab.)
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)
GRYGOREV	96	PAN 59 2105	V.K. Grigoriev, O.N. Baloshin, B.P. Barkov	(ITEP)
Translated from YAF 59 2187.				
YABUKI	95	JPSJ 64 435	F. Yabuki <i>et al.</i>	(VENUS Collab.)
PROKOSHKIN	94	PD 39 420	Y.D. Prokoshkin, A.A. Kondashov	(SERP)
Translated from DANS 336 613.				
BEHREND	92	ZPHY C56 381	H.J. Behrend	(CELLO Collab.)
BLINOV	92	ZPHY C53 33	A.E. Blinov <i>et al.</i>	(NOVO)
AGUILAR-...	91	ZPHY C50 405	M. Aguilar-Benitez <i>et al.</i>	(LEBC-EHS Collab.)
AKER	91	PL B260 249	E. Aker <i>et al.</i>	(Crystal Barrel Collab.)
ADACHI	90D	PL B234 185	I. Adachi <i>et al.</i>	(TOPAZ Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BOYER	90	PR D42 1350	J. Boyer <i>et al.</i>	(Mark II Collab.)
BREAKSTONE	90	ZPHY C48 569	A.M. Breakstone <i>et al.</i>	(ISU, BGNA, CERN+)
MARSISKE	90	PR D41 3324	H. Marsiske <i>et al.</i>	(Crystal Ball Collab.)
MORGAN	90	ZPHY C48 623	D. Morgan, M.R. Pennington	(RAL, DURH)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
AUGUSTIN	89	NP B320 1	J.E. Augustin, G. Cosme	(DM2 Collab.)
VOROBYEV	88	SJNP 48 273	P.V. Vorobiev <i>et al.</i>	(NOVO)
Translated from YAF 48 436.				
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
ABACHI	86B	PRL 57 1990	S. Abachi <i>et al.</i>	(PURD, ANL, IND, MICH+)
AIHARA	86B	PRL 57 404	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
LANDRO	86	PL B172 445	M. Landro, K.J. Mork, H.A. Olsen	(UTRO)
LONGACRE	86	PL B177 223	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)
LYTH	85	JP G11 459	D.H. Lyth	
BEHREND	84B	ZPHY C23 223	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
BERGER	84	ZPHY C26 199	C. Berger <i>et al.</i>	(PLUTO Collab.)
COURAU	84	PL 147B 227	A. Courau <i>et al.</i>	(CIT, SLAC)
SMITH	84C	PR D30 851	J.R. Smith <i>et al.</i>	(SLAC, LBL, HARV)
BINON	83	NC 78A 313	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Also		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
Translated from YAF 38 934.				

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CHABAUD	83	NP B223 1	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
MENNESSIER	83	ZPHY C16 241	G. Mennessier	(MONP)
APEL	82	NP B201 197	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
EDWARDS	82F	PL 110B 82	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
BRANDELIK	81B	ZPHY C10 117	R. Brandelik <i>et al.</i>	(TASSO Collab.)
CHABAUD	81	APP B12 575	V. Chabaud <i>et al.</i>	(CERN, CRAC, MPIM)
GIDAL	81	PL 107B 153	G. Gidal <i>et al.</i>	(SLAC, LBL)
ROUSSARIE	81	PL 105B 304	A. Roussarie <i>et al.</i>	(SLAC, LBL)
BERGER	80B	PL 94B 254	C. Berger <i>et al.</i>	(PLUTO Collab.)
COSTA	80	NP B175 402	G. Costa <i>et al.</i>	(BARI, BONN, CERN, GLAS+)
LOVERRE	80	ZPHY C6 187	P.F. Loverre <i>et al.</i>	(CERN, CDEF, MADR+)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
MARTIN	79	NP B158 520	A.D. Martin, E.N. Ozmutlu	(DURH)
POLYCHRO...	79	PR D19 1317	V.A. Polychronakos <i>et al.</i>	(NDAM, ANL)
PDG	78	PL 75B 1	C. Bricman <i>et al.</i>	
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
PAWLICKI	77	PR D15 3196	A.J. Pawlicki <i>et al.</i>	(ANL)
DEUTSCH...	76	NP B103 426	M. Deuschmann <i>et al.</i>	(AACH3, BERL, BONN+)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
EMMS	75D	NP B96 155	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)
EISENBERG	74	PL 52B 239	Y. Eisenberg <i>et al.</i>	(REHO)
ENGLER	74	PR D10 2070	A. Engler <i>et al.</i>	(CMU, CASE)
LOUIE	74	PL 48B 385	J. Louie <i>et al.</i>	(SACL, CERN)
ANDERSON	73	PRL 31 562	J.C. Anderson <i>et al.</i>	(CMU, CASE)
TAKAHASHI	72	PR D6 1266	K. Takahashi <i>et al.</i>	(TOHOK, PENN, NDAM+)
BEAUPRE	71	NP B28 77	J.V. Beaupre <i>et al.</i>	(AACH, BERL, CERN)
FLATTE	71	PL 34B 551	S.M. Flatte <i>et al.</i>	(LBL)
ARMENISE	70	LNC 4 199	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ)
OH	70	PR D1 2494	B.Y. Oh <i>et al.</i>	(WISC, TINTO) JP
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+)
ARMENISE	68	NC 54A 999	N. Armenise <i>et al.</i>	(BARI, BGNA, FIRZ+)
ASCOLI	68D	PRL 21 1712	G. Ascoli <i>et al.</i>	(ILL)
BOESEBECK	68	NP B4 501	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)
JOHNSON	68	PR 176 1651	P.B. Johnson <i>et al.</i>	(NDAM, PURD, SLAC)
EISNER	67	PR 164 1699	R.L. Eisner <i>et al.</i>	(PURD)
DERADO	65	PRL 14 872	I. Derado <i>et al.</i>	(NDAM)
LEE	64	PRL 12 342	Y.Y. Lee <i>et al.</i>	(MICH)
BONDAR	63	PL 5 153	L. Bondar <i>et al.</i>	(AACH, BIRM, BONN, DESY+)

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NODE=M008

$f_1(1285)$

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

$f_1(1285)$ MASS

NODE=M008M

NODE=M008M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1281.9 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
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	$450 pp \rightarrow pp2(\pi^+ \pi^-)$
1281 ± 1		BARBERIS	97C OMEG	$450 pp \rightarrow ppK_S^0 K^\pm \pi^\mp$
1280 ± 2		3 ANTINORI	95 OMEG	$300,450 pp \rightarrow pp2(\pi^+ \pi^-)$
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	$300 pp \rightarrow K \bar{K} \pi pp$
1278 ± 2		ARMSTRONG	89G OMEG	$85 \pi^+ p \rightarrow 4\pi \pi p, pp \rightarrow 4\pi pp$

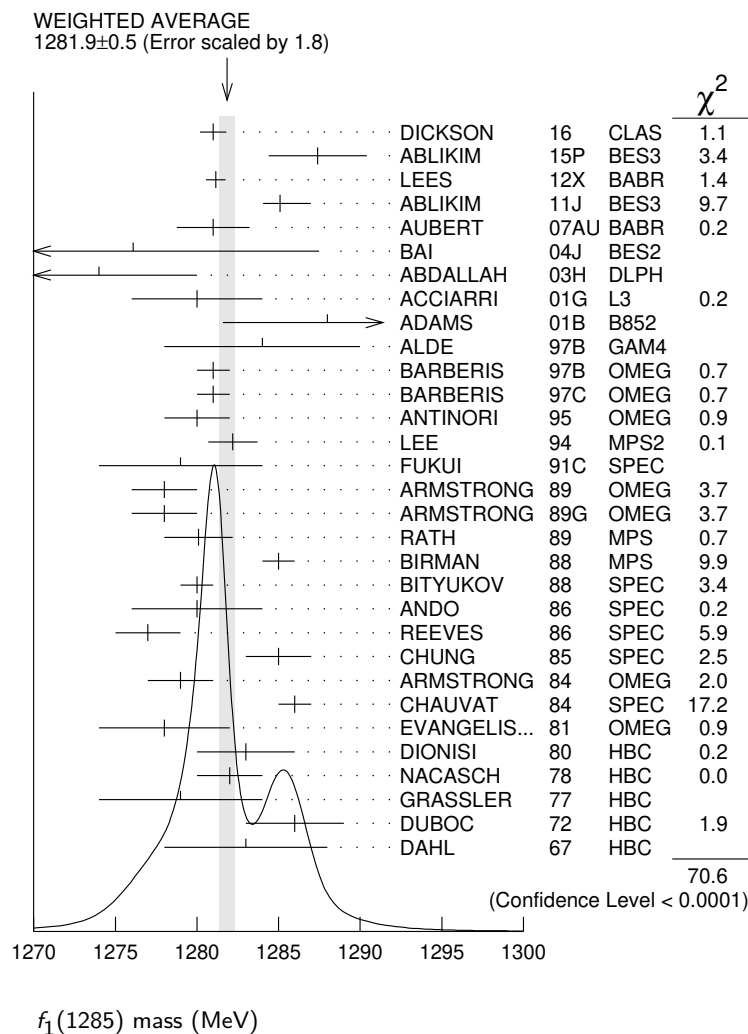
1280.1 ± 2.1	60	RATH	89	MPS	21.4 $\pi^- p \rightarrow K_S^0 K_S^0 \pi^0 n$
1285 ± 1	4750	⁴ BIRMAN	88	MPS	8 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1280 ± 1	504	BITYUKOV	88	SPEC	32.5 $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1280 ± 4		ANDO	86	SPEC	8 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
1277 ± 2	420	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	$e^+ e^- \rightarrow \phi K \bar{K} \pi$
1286 ± 9		GIDAL	87	MRK2	$e^+ e^- \rightarrow e^+ e^- \eta \pi^+ \pi^-$
1287 ± 5	353	BITYUKOV	84B	SPEC	32 $\pi^- p \rightarrow K^+ K^- \pi^0 n$
~ 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	4.2 $K^- p \rightarrow n \eta 2\pi$
~ 1275.0	46	⁷ STANTON	79	CNTR	8.5 $\pi^- p \rightarrow n 2\gamma 2\pi$
1271 ± 10	34	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow K^+ K^- \pi n$
1295 ± 12	85	CORDEN	78	OMEG	12-15 $\pi^- p \rightarrow n 5\pi$
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 $\pi^+ p \rightarrow p 6\pi$
1283 ± 6		BOESEBECK	71	HBC	16.0 $\pi p \rightarrow p 5\pi$
1270 ± 10		CAMPBELL	69	DBC	2.7 $\pi^+ d$
1285 ± 7		LORSTAD	69	HBC	0.7 $\bar{p} p$, 4,5-body
1290 ± 7		D'ANDLAU	68	HBC	1.2 $\bar{p} p$, 5-6 body

OCCUR=2

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.

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$f_1(1285)$ 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
22.7± 1.1 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
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 ^{+2.0} _{-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 $p \bar{p} \rightarrow K K \pi X$

NODE=M008W

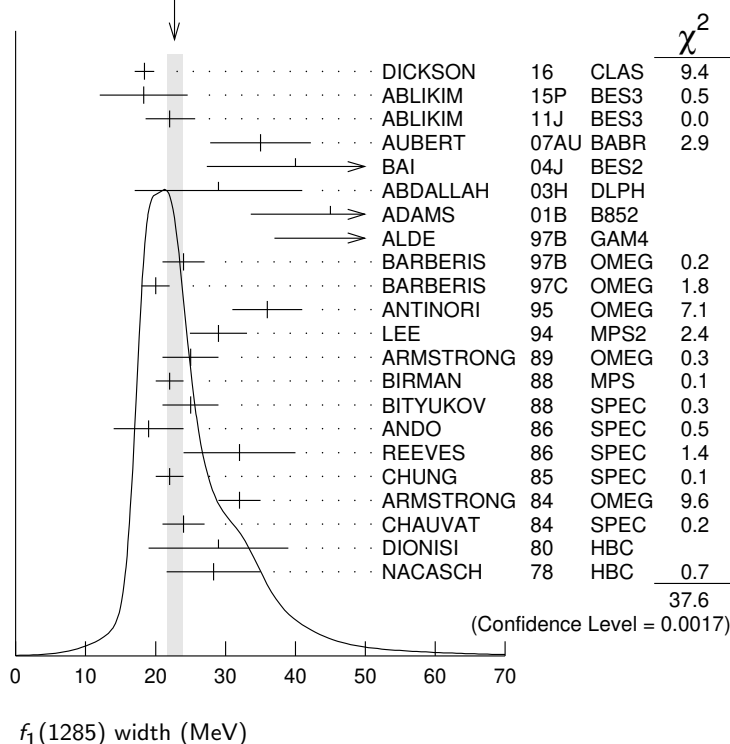
22 ± 2		CHUNG	85	SPEC	$8 \pi^- p \rightarrow NK\bar{K}\pi$
32 ± 3	604	ARMSTRONG	84	OMEG	$85 \pi^+ p \rightarrow K\bar{K}\pi\pi p,$ $pp \rightarrow K\bar{K}\pi pp$
24 ± 3		CHAUVAT	84	SPEC	ISR 31.5 pp
29 ± 10	103	DIONISI	80	HBC	$4 \pi^- p \rightarrow K\bar{K}\pi n$
28.3 ± 6.7	320	NACASCH	78	HBC	$0.7, 0.76 \bar{p} p \rightarrow K\bar{K}3\pi$
• • • 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	$pp \rightarrow p_{\text{slow}} (K_S^0 K^+\pi^-)$
19.4 ± 1.5		4 SOSA	99	SPEC	$pp \rightarrow p_{\text{slow}}^{P_{\text{fast}}} (K_S^0 K^-\pi^+)$
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	$8.5 \pi^- p \rightarrow n2\gamma 2\pi$
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	$1.2 \bar{p} p \rightarrow 2K4\pi$
37 ± 5	500	7 THUN	72	MMS	$13.4 \pi^- p$
10 ± 10		BOESEBECK	71	HBC	$16.0 \pi p \rightarrow p5\pi$
30 ± 15		CAMPBELL	69	DBC	$2.7 \pi^+ d$
60 ± 15		6 LORSTAD	69	HBC	$0.7 \bar{p} p, 4,5\text{-body}$
35 ± 10		6 DAHL	67	HBC	$1.6\text{--}4.2 \pi^- p$

OCCUR=2

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.

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 NODE=M008W;LINKAGE=P
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 NODE=M008W;LINKAGE=S

WEIGHTED AVERAGE
 22.7 ± 1.1 (Error scaled by 1.5)



$f_1(1285)$ DECAY MODES

NODE=M008215;NODE=M008

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 4π	$(32.7 \pm 1.9) \%$	$S=1.2$	DESIG=21
Γ_2 $\pi^0 \pi^0 \pi^+ \pi^-$	$(21.8 \pm 1.3) \%$	$S=1.2$	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 $\eta \pi \pi$	$(52.2 \pm 2.0) \%$	$S=1.2$	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	-30			
x_{10}	-12	-88		
x_{11}	22	-10	-4	
x_{15}	-25	-7	-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 $\pm$ 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.		
0.271±0.016 OUR AVERAGE	Error includes scale factor of 1.2.		
0.265±0.014	¹ BARBERIS	97C	OMEG 450 $pp \rightarrow ppK_S^0 K^\pm \pi^\mp$
0.28 ±0.05	² ARMSTRONG	89E	OMEG 300 $pp \rightarrow pp f_1(1285)$
0.37 ±0.03 ±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
NODE=M008R1NODE=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±0.013 OUR FIT	Error includes scale factor of 1.2.

NODE=M008R18
NODE=M008R18 **$\Gamma(2\pi^+2\pi^-)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$**

VALUE	DOCUMENT ID
0.109±0.006 OUR FIT	Error includes scale factor of 1.2.

NODE=M008R17
NODE=M008R17 **$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$** **$\Gamma_4/\Gamma = \frac{1}{3}\Gamma_1/\Gamma$**

VALUE	DOCUMENT ID
0.109±0.006 OUR FIT	Error includes scale factor of 1.2.

NODE=M008R19
NODE=M008R19 **$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2\pi^+2\pi^-)$** **$\Gamma_4/\Gamma_3$**

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 $\pi^\pm p$

NODE=M008R6
NODE=M008R6 **$\Gamma(\rho^0\rho^0)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE	DOCUMENT ID	COMMENT
seen	BARBERIS	00C 450 $pp \rightarrow p_f 4\pi p_s$

NODE=M008R21
NODE=M008R21 **$\Gamma(4\pi^0)/\Gamma_{\text{total}}$** **$\Gamma_6/\Gamma$**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	ALDE	87	GAM4 100 $\pi^-\pi^0 \rightarrow 4\pi^0 n$

NODE=M008R8
NODE=M008R8 **$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\eta\pi^+\pi^-)$** **$\Gamma_{13}/\Gamma_7$**

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.86±0.16±0.20	2.3k	¹ DOROFEEV	11	VES $\pi^- N \rightarrow \pi^- f_1(1285) N$

NODE=M008R02
NODE=M008R02¹ 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±0.020 OUR FIT	Error includes scale factor of 1.2.

NODE=M008R22
NODE=M008R22 **$\Gamma(4\pi)/\Gamma(\eta\pi\pi)$** **$\Gamma_1/\Gamma_8 = \Gamma_1/(\Gamma_9+\Gamma_{10})$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.63±0.06 OUR FIT	Error includes scale factor of 1.3.		
0.41±0.14 OUR AVERAGE			

NODE=M008R4
NODE=M008R40.37±0.11±0.11 BOLTON 92 MRK3 $J/\psi \rightarrow \gamma f_1(1285)$ 0.64±0.40 GURTU 79 HBC 4.2 $K^-\pi$

• • • 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=M008R04¹ Assuming $B(f_1(1285) \rightarrow \pi\pi\eta) = 3/2 B(f_1(1285) \rightarrow \pi^+\pi^-\eta)$.

NODE=M008R04;LINKAGE=LE

$\Gamma(a_0(980)\pi \text{ [ignoring } a_0(980) \rightarrow K\bar{K}])/\Gamma(\eta\pi\pi)$

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
 $\Gamma(K\bar{K}\pi)/\Gamma(\eta\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

0.172±0.012 OUR FIT Error includes scale factor of 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 $p p \rightarrow p_f f_1(1285)p_s$ 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 $\pi^+ d$ ¹ CORDEN 78 assumes low-mass $\eta\pi\pi$ region is dominantly 1^{++} . See BARBERIS 98C and MANAK 00A for discussion.² $K\bar{K}$ system characterized by the $I = 1$ threshold enhancement. (See under $a_0(980)$).NODE=M008R2
NODE=M008R2

OCCUR=2

NODE=M008R2;LINKAGE=CD

NODE=M008R2;LINKAGE=K

 $\Gamma(K\bar{K}^*(892))/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow e^+e^-K_S^0 K^\pm \pi^\mp$ ¹ A clear signal of 19.8 ± 4.4 events observed at high Q^2 .NODE=M008R5
NODE=M008R5

NODE=M008R5;LINKAGE=CH

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

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

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

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT

<0.31 95 DOROFEEV 11 VES $\pi^- N \rightarrow \pi^- f_1(1285)N$ NODE=M008R03
NODE=M008R03
 $\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$

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

6.1±1.0 OUR FIT Error includes scale factor of 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

NODE=M008R15;LINKAGE=A

 $\Gamma(\gamma\rho^0)/\Gamma(2\pi^+2\pi^-)$

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

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

$$\Gamma_8/\Gamma_{15} = (\Gamma_9 + \Gamma_{10})/\Gamma_{15}$$

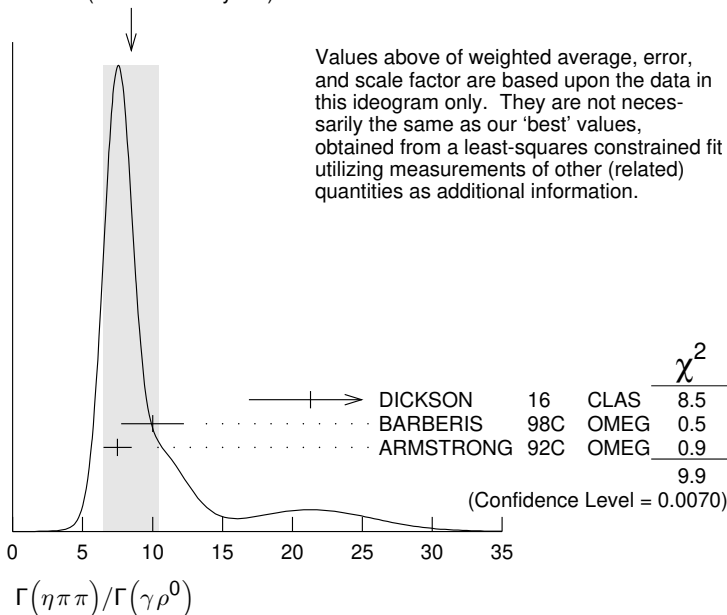
VALUE	DOCUMENT ID	TECN	COMMENT
8.6±1.6 OUR FIT	Error includes scale factor of 1.9.		
8.5±2.0 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.		
21.3±4.4	DICKSON	16	CLAS $\gamma\rho \rightarrow f_1(1285)\rho$
10.0±1.0±2.0	BARBERIS	98C	OMEG 450 $pp \rightarrow p_f f_1(1285)p_s$
7.5±1.0	¹ ARMSTRONG	92C	OMEG 300 $pp \rightarrow pp\pi^+\pi^-\gamma, pp\eta\pi^+\pi^-$

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)



$$\Gamma(\gamma\rho^0)/\Gamma(K\bar{K}\pi)$$

$$\Gamma_{15}/\Gamma_{11}$$

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

$$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$$

$$\Gamma_{16}/\Gamma_{11}$$

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

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

$$\Gamma_{17}/\Gamma$$

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

ACHASOV	20	PL B800 135074	M.N. Achasov <i>et al.</i>	(SND Collab.)	REFID=60144
ABLIKIM	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
DICKSON	16	PR C93 065202	R. Dickson <i>et al.</i>	(JLab CLAS Collab.)	REFID=57487
ABLIKIM	15P	PR D92 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56781
AAIJ	14Y	PRL 112 091802	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55837
LEES	12X	PR D86 092010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54714
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53931
DOROFEEV	11	EPJ A47 68	V. Dorofeev <i>et al.</i>	(SERP, MIPT)	REFID=16755
PDG	10	JP G37 075021	K. Nakamura <i>et al.</i>	(PDG Collab.)	REFID=53229
ACHARD	07	JHEP 0703 018	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=51698
AUBERT	07AU	PR D76 092005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52049
BAI	04J	PL B594 47	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=50167

NODE=M008

ABDALLAH	03H	PL B569 129	J. Abdallah <i>et al.</i>	(DELPHI Collab.)	REFID=49548
ACHARD	02B	PL B526 269	P. Achard <i>et al.</i>	(L3 Collab.)	REFID=48574
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
BARBERIS	00C	PL B471 440	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47959
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
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
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
Translated from YAF 60 458.					
BARBERIS	97B	PL B413 217	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45758
BARBERIS	97C	PL B413 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=45759
AMELIN	95	ZPHY C66 71	D.V. Amelin <i>et al.</i>	(VES Collab.)	REFID=44376
ANTINORI	95	PL B353 589	F. Antinori <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44437
ABATZIS	94	PL B324 509	S. Abatzis <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=44090
LEE	94	PL B323 227	J.H. Lee <i>et al.</i>	(BNL, IND, KYUN, MASD+)	REFID=44092
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)	REFID=43587
ARMSTRONG	92C	ZPHY C54 371	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+)	REFID=42097
BOLTON	92	PL B278 495	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42175
BITYUKOV	91B	SJNP 54 318	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=41864
Translated from YAF 54 529.					
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
ARMSTRONG	89	PL B221 216	T.A. Armstrong <i>et al.</i>	(CERN, CDEF, BIRM+)	REFID=40729
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
ARMSTRONG	89G	ZPHY C43 55	T.A. Armstrong <i>et al.</i>	(CERN, BIRM, BARI+)	REFID=40930
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
AIHARA	88B	PL B209 107	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=40572
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
BITYUKOV	88	PL B203 327	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=40569
MIR	88	Photon-Photon 88, 126	R. Mir	(Mark III Collab.)	REFID=41574
Conference					
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)	REFID=40221
BECKER	87	PRL 59 186	J.J. Becker <i>et al.</i>	(Mark III Collab.)	REFID=40015
GIDAL	87	PRL 59 2012	G. Gidal <i>et al.</i>	(LBL, SLAC, HARV)	REFID=40223
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ARMSTRONG	84	PL 146B 273	T.A. Armstrong <i>et al.</i>	(ATHU, BARI, BIRM+) JP	REFID=20929
BITYUKOV	84B	PL 144B 133	S.I. Bitukov <i>et al.</i>	(SERP)	REFID=20468
CHAUVAT	84	PL 148B 382	P. Chauvat <i>et al.</i>	(CERN, CLER, UCLA+)	REFID=20932
TORNQVIST	82B	NP B203 268	N.A. Tornqvist	(HELS)	REFID=20573
EVANGELIS...	81	NP B178 197	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
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+)	REFID=20924
GURTU	79	NP B151 181	A. Gurtu <i>et al.</i>	(CERN, ZEEM, NIJM, OXF)	REFID=20456
STANTON	79	PRL 42 346	N.R. Stanton <i>et al.</i>	(OSU, CARL, MCGI+) JP	REFID=20887
CORDEN	78	NP B144 253	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+) JP	REFID=20452
NACASCH	78	NP B135 203	R. Nacasch <i>et al.</i>	(PARIS, MADR, CERN)	REFID=20919
GRASSLER	77	NP B121 189	H. Grassler <i>et al.</i>	(AACH3, BERL, BONN+)	REFID=20447
DEFOIX	72	NP B44 125	C. Defoix <i>et al.</i>	(CDEF, CERN)	REFID=20435
DUBOC	72	NP B46 429	J. Duboc <i>et al.</i>	(PARIS, LIVP)	REFID=20339
THUN	72	PRL 28 1733	R. Thun <i>et al.</i>	(STON, NEAS)	REFID=20911
BARDADIN-...	71	PR D4 2711	M. Bardadin-Otwinowska <i>et al.</i>	(WARS)	REFID=20196
BOESEBECK	71	PL 34B 659	K. Boesebeck	(AACH, BERL, BONN, CERN, CRAC+)	REFID=20905
CAMPBELL	69	PRL 22 1204	J.H. Campbell <i>et al.</i>	(PURD)	REFID=20419
LORSTAD	69	NP B14 63	B. Lorstad <i>et al.</i>	(CDEF, CERN) JP	REFID=20901
D'ANDLAU	68	NP B5 693	C. d'Andlau <i>et al.</i>	(CDEF, CERN, IRAD+) IJP	REFID=20897
DAHL	67	PR 163 1377	O.I. Dahl <i>et al.</i>	(LRL) IJP	REFID=20321

$\eta(1295)$

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

See the review on "Pseudoscalar and pseudovector mesons in the 1400 MeV region."

NODE=M037

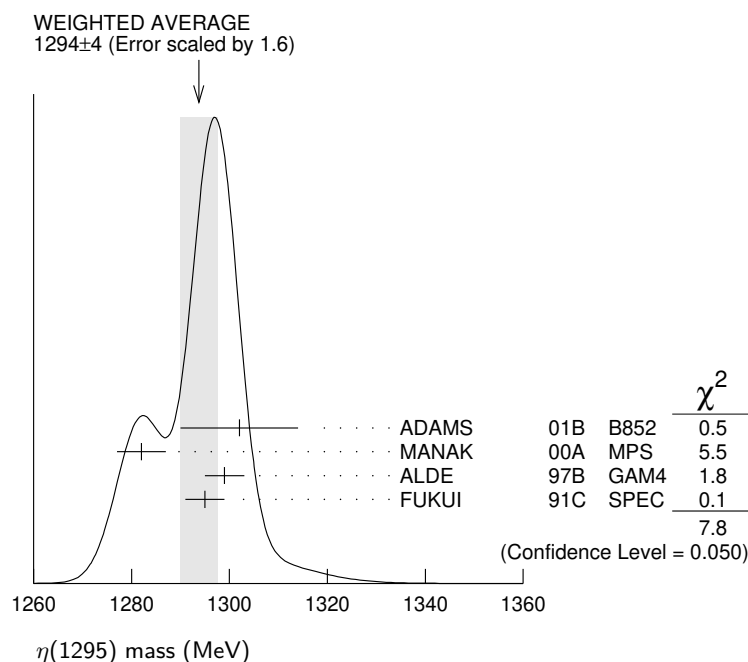
NODE=M037

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

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		² AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
~ 70		STANTON	79 CNTR	8.4 $\pi^- p \rightarrow n \eta 2\pi$

² PWA analysis of AUGUSTIN 92 assigns 0^{-+} quantum numbers to this state rather than 1^{++} as before.

NODE=M037W

NODE=M037W

NODE=M037W;LINKAGE=AG

$\eta(1295)$ DECAY MODES

NODE=M037215;NODE=M037

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 $\sigma\eta$	
Γ_7 $K\bar{K}\pi$	

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6
 DESIG=7

 $\eta(1295) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M037220

$\Gamma(\eta\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.066	95	ACCIARRI	01G L3	183–202 $e^+e^- \rightarrow e^+e^-\eta\pi^+\pi^-$	
• • • 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	$e^+e^- \rightarrow e^+e^-\eta\pi\pi$	

NODE=M037G2
 NODE=M037G2

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_7\Gamma_3/\Gamma$
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.014	90	3,4 AHOHE	05 CLE2	10.6 $e^+e^- \rightarrow e^+e^-K_S^0K^\pm\pi^\mp$	

NODE=M037G3
 NODE=M037G3

³ Using $\eta(1295)$ mass and width 1294 MeV and 55 MeV, respectively.⁴ 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

NODE=M037225

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$				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=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	⁵ ALDE	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0n$	

NODE=M037R2
 NODE=M037R2

⁵ 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 $\pi^-p \rightarrow \eta\pi^0\pi^0n$	

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

NODE=M037

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-2γ 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

REFID=50764
 REFID=48319
 REFID=49649
 REFID=47989
 REFID=45396
 REFID=45417
 REFID=41584
 REFID=41748
 REFID=41352
 REFID=40564
 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				
• • • 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

→ UNCHECKED ←

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				
• • • 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

→ UNCHECKED ←

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

$\Gamma(\rho\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_3/\Gamma$
<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

$\Gamma(\pi(\pi\pi)_{S\text{-wave}})/\Gamma(\rho\pi)$			Γ_2/Γ_1		
VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.2 ± 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+)
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+)
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

$a_2(1320)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

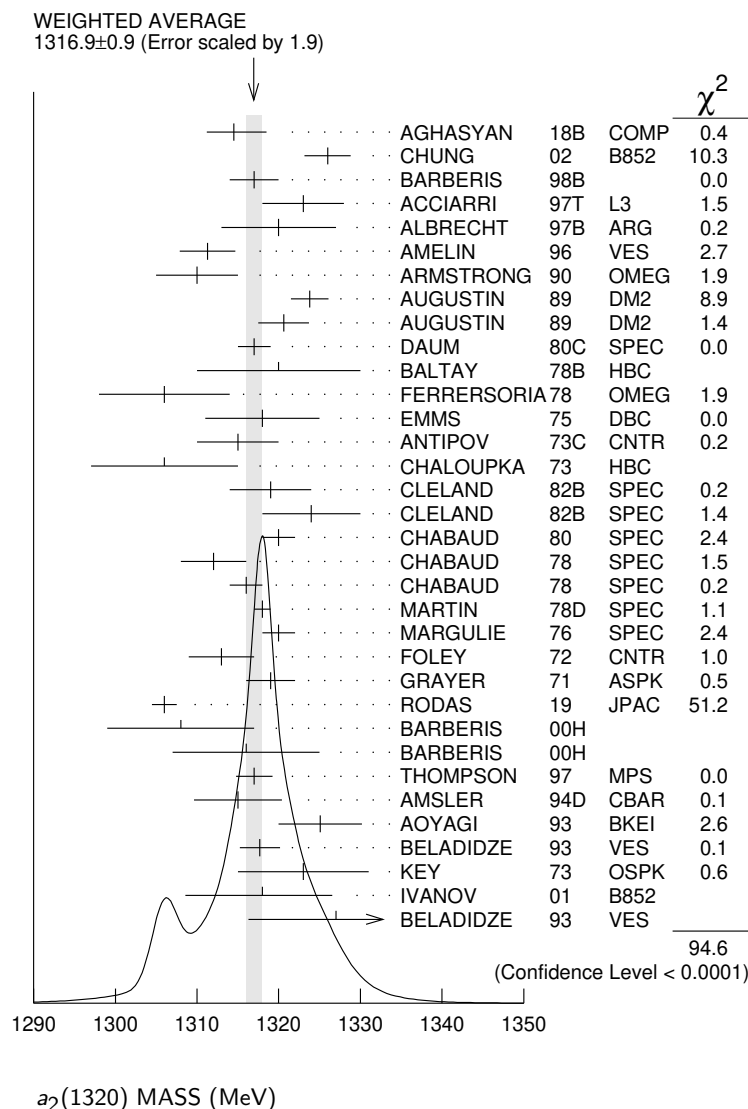
NODE=M012

$a_2(1320)$ MASS

NODE=M012M0

VALUE (MeV) DOCUMENT ID
1316.9±0.9 OUR AVERAGE Includes data from the 4 datablocks that follow this one.
Error includes scale factor of 1.9. See the ideogram below.

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.

1318.6± 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 ± 2 ± 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 ± 4 ± 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± 1.6±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 ±	$J/\psi \rightarrow \rho^\pm a_2^\mp$
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 $\pi^- p$

NODE=M012M1
NODE=M012M1

OCCUR=2

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

1321	± 1	$^{+0}_{-7}$	420k	³	ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$	
1300	± 2	± 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	$0 15 \pi^+ p \rightarrow \Delta 3 \pi$	OCCUR=2
1309	± 5		5k		BINNIE	71	MMS	$- \pi^- p \text{ near } a_2 \text{ thresh- old}$	OCCUR=2
1299	± 6		28k		BOWEN	71	MMS	$- 5 \pi^- p$	
1300	± 6		24k		BOWEN	71	MMS	$+ 5 \pi^+ p$	OCCUR=2
1309	± 4		17k		BOWEN	71	MMS	$- 7 \pi^- p$	OCCUR=3
1306	± 4		941		ALSTON-...	70	HBC	$+ 7.0 \pi^+ p \rightarrow 3 \pi p$	

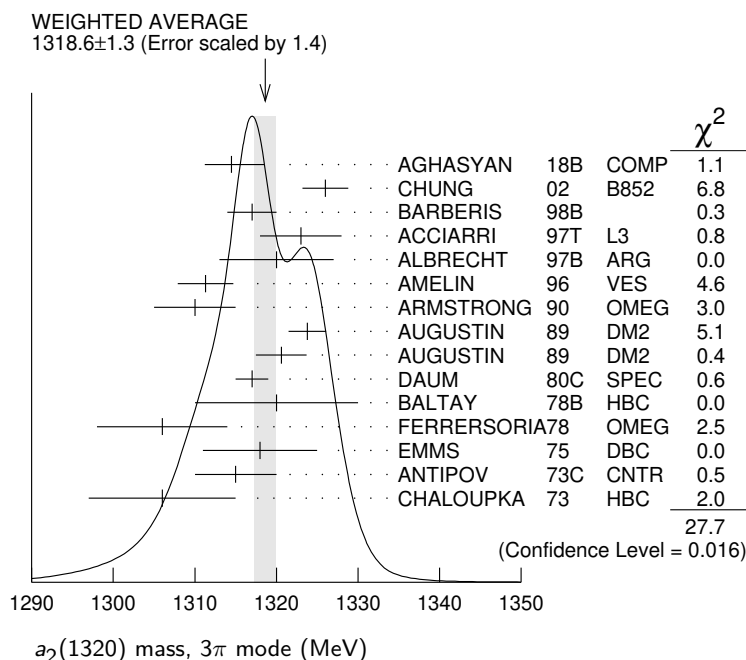
¹ Statistical error negligible.

² From a fit to $J^P = 2^+ \rho \pi$ partial wave.

³ Superseded by AGHASYAN 2018B.

⁴ From analysis of L3 data at 183–209 GeV.

NODE=M012M1;LINKAGE=D
NODE=M012M1;LINKAGE=P
NODE=M012M1;LINKAGE=C
NODE=M012M1;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.

1318.1 $\pm$ 0.7 OUR AVERAGE

1319	± 5	4700	^{1,2}	CLELAND	82B	SPEC	+	$50 \pi^+ p \rightarrow K_S^0 K^+ p$	OCCUR=2
1324	± 6	5200	^{1,2}	CLELAND	82B	SPEC	-	$50 \pi^- p \rightarrow K_S^0 K^- p$	OCCUR=3
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	-	$18.8 \pi^- p \rightarrow K^- K_S^0 p$	OCCUR=2
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	-	$17.2 \pi^- p \rightarrow K^- K_S^0 p$	

• • • 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.

1312.2 ± 2.8 OUR AVERAGE Error includes scale factor of 2.6. See the ideogram below.

1306.0 ± 0.8 ± 1.3	1	RODAS	19	JPAC	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1308 ± 9		BARBERIS	00H		450 $p p \rightarrow p_f \eta \pi^0 p_s$
1316 ± 9		BARBERIS	00H		450 $p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$

OCCUR=2

1317 ± 1 ± 2		THOMPSON	97	MPS	18 $\pi^- p \rightarrow \eta \pi^- p$
1315 ± 5 ± 2	2	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	3 KEY	73	OSPK	6 $\pi^- p \rightarrow p \pi^- \eta$

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

1312.5 ± 0.7 ± 2.6	4	ALBRECHT	20	RVUE	0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
1307 ± 1 ± 6	5	JACKURA	18	JPAC	$\pi^- p \rightarrow \eta \pi^- p$
1315 ± 12	6	ADOLPH	15	COMP	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1309 ± 4		ANISOVICH	09	RVUE	$\bar{p} p, \pi N$
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	3,7 CONFORTO	73	OSPK	- 6 $\pi^- p \rightarrow p \pi^- \eta$

OCCUR=2

¹ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15data. The mass is extracted from the T-matrix pole.

² The systematic error of 2 MeV corresponds to the spread of solutions.

³ Error includes 5 MeV systematic mass-scale error.

⁴ T-matrix pole with 2 poles, 2 channels ($\pi^0 \eta$ and $K\bar{K}$).

⁵ Superseded by RODAS 19.

⁶ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.

⁷ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012M3;LINKAGE=C

NODE=M012M3;LINKAGE=DD

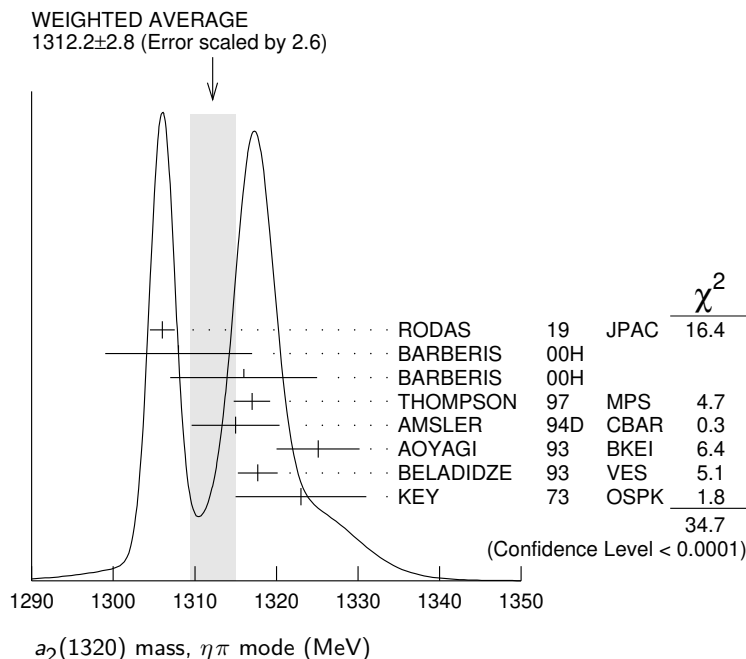
NODE=M012M3;LINKAGE=E

NODE=M012M3;LINKAGE=D

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.

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 $\pi^- N \rightarrow \eta' \pi^- N$

NODE=M012M4

NODE=M012M4

$a_2(1320)$ WIDTH

NODE=M012210

3 π MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

 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 ± 3 ± 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 ± 10 ± 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 ± 6.0 ± 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	$J/\psi \rightarrow \rho^0 a_2^0$
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 $\pi^+ p$
103 ± 5	17k	BOWEN	71	MMS -	7 $\pi^- p$

OCCUR=2

OCCUR=2

OCCUR=3

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

110 ± 2 $^{+2}_{-15}$	420k	⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
117 ± 6 ± 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 $\pi^+ p \rightarrow \Delta 3\pi$
72 ± 16	5k	BINNIE	71	MMS -	$\pi^- p$ near a_2 thresh- old
79 ± 12	941	ALSTON-...	70	HBC +	7.0 $\pi^+ p \rightarrow 3\pi p$

OCCUR=2

OCCUR=2

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=S
 $K\bar{K}$ AND $\eta\pi$ MODES

VALUE (MeV)	DOCUMENT ID

107 ± 5 OUR ESTIMATE**112.5 ± 1.2 OUR AVERAGE** Includes data from the 2 datablocks that follow this one.

NODE=M012W0

NODE=M012W0

→ UNCHECKED ←

 $K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M012W2

NODE=M012W2

The data in this block is included in the average printed for a previous datablock.

109.8 ± 2.4 OUR AVERAGE

112 ± 20	4700	^{1,2} CLELAND	82B	SPEC +	50 $\pi^+ p \rightarrow K_S^0 K^+ p$
120 ± 25	5200	^{1,2} CLELAND	82B	SPEC -	50 $\pi^- p \rightarrow K_S^0 K^- p$
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 $\pi^- p \rightarrow K^- K_S^0 p$
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 $\pi^- p \rightarrow K^- K_S^0 p$

OCCUR=2

OCCUR=3

OCCUR=2

• • • 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

113.4 $\pm$ 1.3 OUR AVERAGE

114.4 $\pm$ 1.6 $\pm$ 0.0	¹ RODAS	19	JPAC	191	$\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
115 $\pm$ 20	BARBERIS	00H		450	$p p \rightarrow p_f \eta \pi^0 p_s$
112 $\pm$ 14	BARBERIS	00H		450	$p p \rightarrow \Delta_f^{++} \eta \pi^- p_s$
112 $\pm$ 3 $\pm$ 2	² AMSLER	94D	CBAR	0.0	$\bar{p} p \rightarrow \pi^0 \pi^0 \eta$
103 $\pm$ 6 $\pm$ 3	BELADIDZE	93	VES	37	$\pi^- N \rightarrow \eta \pi^- N$
112.2 $\pm$ 5.7	2561 DELFOSSE	81	SPEC	+	$\pi^\pm p \rightarrow p \pi^\pm \eta$
116.6 $\pm$ 7.7	1653 DELFOSSE	81	SPEC	-	$\pi^\pm p \rightarrow p \pi^\pm \eta$
108 $\pm$ 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. • • •

106.9 $\pm$ 1.2 $\pm$ 3.7	³ ALBRECHT	20	RVUE	0.9	$\bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
112 $\pm$ 1 $\pm$ 8	⁴ JACKURA	18	JPAC		$\pi^- p \rightarrow \eta \pi^- p$
119 $\pm$ 14	⁵ ADOLPH	15	COMP	191	$\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
110 $\pm$ 4	ANISOVICH	09	RVUE		$\bar{p} p, \pi N$
127 $\pm$ 2 $\pm$ 2	⁶ THOMPSON	97	MPS	18	$\pi^- p \rightarrow \eta \pi^- p$
118 $\pm$ 10	ARMSTRONG	93C	E760	0	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
104 $\pm$ 9	6200 ⁷ CONFORTO	73	OSPK	-	$6 \pi^- p \rightarrow p \pi^- \eta$

¹ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15data. The width is extracted from the T-matrix pole.

² The systematic error of 2 MeV corresponds to the spread of solutions.

³ T-matrix pole with 2 poles, 2 channels ($\pi^0 \eta$ and $K\bar{K}$).

⁴ Superseded by RODAS 19.

⁵ ADOLPH 15 value is derived from a Breit-Wigner fit with mass-dependent width taking the $\eta\pi$ and $\rho\pi$ channels into account.

⁶ Resolution is not unfolded.

⁷ Missing mass with enriched MMS = $\eta\pi^-$, $\eta = 2\gamma$.

NODE=M012W3;LINKAGE=E

NODE=M012W3;LINKAGE=DD
NODE=M012W3;LINKAGE=F
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

119 $\pm$ 25 OUR AVERAGE

140 $\pm$ 35 $\pm$ 20	IVANOV	01	B852	18	$\pi^- p \rightarrow \eta' \pi^- p$
106 $\pm$ 32	BELADIDZE	93	VES	37	$\pi^- N \rightarrow \eta' \pi^- N$

NODE=M012W4
NODE=M012W4

$a_2(1320)$ DECAY MODES

NODE=M012215;NODE=M012

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1 3π	(70.1 $\pm$ 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 $\pm$ 1.2) %	
Γ_6 $\omega\pi\pi$	(10.6 $\pm$ 3.2) %	S=1.3
Γ_7 $K\bar{K}$	(4.9 $\pm$ 0.8) %	
Γ_8 $\eta'(958)\pi$	(5.5 $\pm$ 0.9) $\times 10^{-3}$	
Γ_9 $\pi^\pm \gamma$	(2.91 $\pm$ 0.27) $\times 10^{-3}$	
Γ_{10} $\gamma\gamma$	(9.4 $\pm$ 0.7) $\times 10^{-6}$	
Γ_{11} $e^+ e^-$	< 5 $\times 10^{-9}$	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

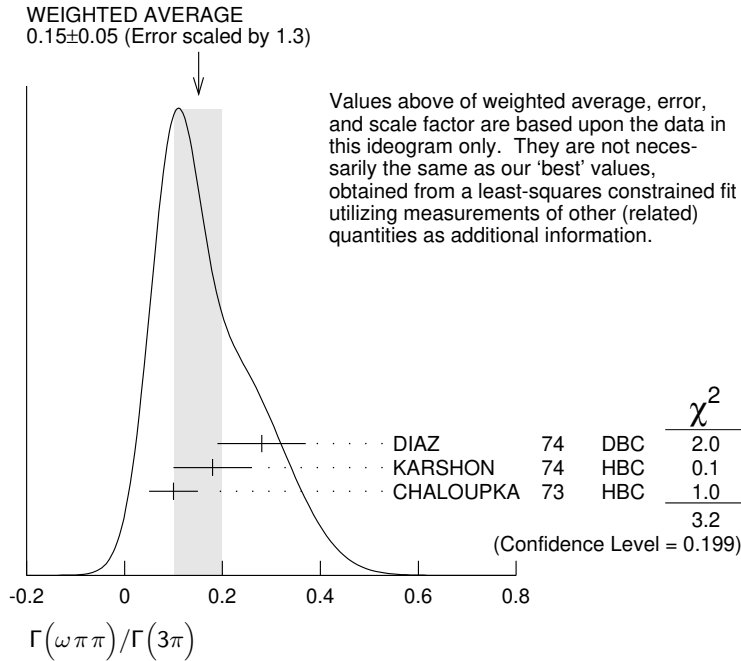
OCCUR=2

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

 **$\Gamma(K\bar{K})/\Gamma(3\pi)$** **$\Gamma_7/\Gamma_1$**

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 $\bar{p}p \rightarrow K^\pm K_s \pi^\mp$
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 ABRAMOVI... 70B	HBC	-	3.93 $\pi^- p$
0.054±0.022		² CHUNG 68	HBC	-	3.2 $\pi^- p$

¹ Using 4 π data from BERTIN 97D.

² Included in CHABAUD 78 review.

NODE=M012R1
NODE=M012R1 **$\Gamma(K\bar{K})/\Gamma(\eta\pi)$** **$\Gamma_7/\Gamma_5$**

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.352±0.011±0.175	¹ 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	² BERTIN 98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_s \pi^\mp$

¹ Residues from T-matrix pole with 2 poles, 2 channels ($\pi^0 \eta$ and $K\bar{K}$).

² Using $\eta\pi\pi$ data from AMSLER 94D.

NODE=M012R1;LINKAGE=BE
NODE=M012R1;LINKAGE=CNODE=M012R14
NODE=M012R14 **$\Gamma(\eta\pi)/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$** **$\Gamma_5/(\Gamma_1+\Gamma_5+\Gamma_7)$**

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 **$\Gamma(K\bar{K})/[\Gamma(3\pi) + \Gamma(\eta\pi) + \Gamma(K\bar{K})]$** **$\Gamma_7/(\Gamma_1+\Gamma_5+\Gamma_7)$**

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
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 $\bar{p}p$

NODE=M012R8
NODE=M012R8

OCCUR=2

¹ Montanet agrees. Vlada.² Not averaged because of discrepancy between masses from $K\bar{K}$ and $\rho\pi$ modes.

NODE=M012R8;LINKAGE=01

NODE=M012R8;LINKAGE=A

 $\Gamma(\eta'(958)\pi)/\Gamma_{\text{total}}$ Γ_8/Γ

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

 $\Gamma(\eta'(958)\pi)/\Gamma(3\pi)$ Γ_8/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

• • • 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 $\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$ Γ_8/Γ_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 $\pi^- C \rightarrow a_2^- C$

¹ Using $B(\eta' \rightarrow \pi^+ \pi^- \eta) = 0.441$, $B(\eta \rightarrow \gamma\gamma) = 0.389$ and $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = 0.236$.NODE=M012R13
NODE=M012R13

NODE=M012R13;LINKAGE=A

 $\Gamma(\pi^\pm \gamma)/\Gamma_{\text{total}}$ Γ_9/Γ

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

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

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 **$a_2(1320)$ REFERENCES**

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.)
ADOLPH	15	PL B740 303	M. Adolph <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.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09A	PR D80 032001	S. Uehara <i>et al.</i>	(BELLE Collab.)
SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
SCHEGELSKY	06A	EPJ A27 207	V.A. Schegelsky <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.)
MOLCHANOV	01	PL B521 171	V.V. Molchanov <i>et al.</i>	(FNAL SELEX Collab.)
ACHASOV	00K	PL B492 8	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)
BARBERIS	00H	PL B488 225	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS	98B	PL B422 399	D. Barberis <i>et al.</i>	(WA 102 Collab.)
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.)
ACCARI	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.)
THOMPSON	97	PRL 79 1630	D.R. Thompson <i>et al.</i>	(BNL E852 Collab.)
AMELIN	96	ZPHY C70 71	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
AMSLER	94D	PL B333 277	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
AOYAGI	93	PL B314 246	H. Aoyagi <i>et al.</i>	(BKEI Collab.)
ARMSTRONG	93C	PL B307 394	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
BELADIDZE	93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)
CONDO	93	PR D48 3045	G.T. Condo <i>et al.</i>	(SLAC Hybrid Collab.)
ALDE	92B	ZPHY C54 549	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
BELADIDZE	92	ZPHY C54 235	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALBRECHT	90G	ZPHY C48 183	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ARMSTRONG	90	ZPHY C48 213	T.A. Armstrong, M. Benayoun, W. Beusch	(WA76 Coll.)
BARU	90	ZPHY C48 581	S.E. Baru <i>et al.</i>	(MD-1 Collab.)

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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
ANTREASIAN	86	ZPHY C31 537	D. Antreasian <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 114B 378	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=20302
CIHANGIR	82	PL 125B 518 (erratum)	S. Cihangir <i>et al.</i>	(FNAL, MINN, ROCH)	REFID=21280
CLELAND	82B	PL 117B 123	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
EDWARDS	82F	NP B208 228	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=20747
DELFOSSSE	81	PL 110B 82	A. Delfosse <i>et al.</i>	(GEVA, LAUS)	REFID=21277
EVANGELIS...	81	NP B183 349	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20462
CHABAUD	80	NP B178 197	V. Chabaud <i>et al.</i>	(CERN, MPIM, AMST)	REFID=21274
DAUM	80C	NP B175 189	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)	REFID=21275
BALTAY	78B	PL 89B 276	C. Baltay <i>et al.</i>	(COLU, BING)	REFID=21265
CHABAUD	78	PR D17 62	V. Chabaud <i>et al.</i>	(CERN, MPIM)	REFID=21267
FERRERSORIA	78	NP B145 349	A. Ferrer Soria <i>et al.</i>	(ORSAY, CERN, CDEF+)	REFID=21270
HYAMS	78	PL 74B 287	B.D. Hyams <i>et al.</i>	(CERN, MPIM, ATEN)	REFID=21271
MARTIN	78D	NP B146 303	A.D. Martin <i>et al.</i>	(DURH, GEVA)	REFID=21272
MAY	77	PL 74B 417	E.N. May <i>et al.</i>	(ROCH, CORN)	REFID=20450
FORINO	76	PR D16 1983	A. Forino <i>et al.</i>	(BGNA, FIRZ, GENO, MILA+)	REFID=21259
MARGULIE	76	NC 35A 465	M. Margulies <i>et al.</i>	(BNL, CUNY)	REFID=21261
EMMS	75	PR D14 667	M.J. Emms <i>et al.</i>	(BIRM, DURH, RHEL)	REFID=21254
WAGNER	75	PL 58B 117	F. Wagner, M. Tabak, D.M. Chew	(LBL) JP	REFID=20843
DIAZ	74	PL 58B 201	J. Diaz <i>et al.</i>	(CASE, CMU)	REFID=21248
KARSHON	74	PRL 32 260	U. Karshon <i>et al.</i>	(REHO)	REFID=21249
ANTIPOV	73	PRL 32 852	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=21238
ANTIPOV	73C	NP B63 175	Y.M. Antipov <i>et al.</i>	(CERN, SERP) JP	REFID=20817
CHALOUPKA	73	NP B63 153	V. Chaloupka <i>et al.</i>	(CERN)	REFID=21242
CONFORTO	73	PL 44B 211	G. Conforto <i>et al.</i>	(EFI, FNAL, TNTO+)	REFID=21243
DEFOIX	73	PL 45B 154	C. Defoix <i>et al.</i>	(CDEF)	REFID=21244
EISENSTEIN	73	PL 43B 141	L. Eisenstein <i>et al.</i>	(ILL)	REFID=21245
KEY	73	PR D7 278	A.W. Key <i>et al.</i>	(TNTO, EFI, FNAL, WISC)	REFID=21246
TOET	73	PRL 30 503	D.Z. Toet <i>et al.</i>	(NIJM, BONN, DURH, TORI)	REFID=20714
DAMERI	72	NP B63 248	M. Dameri <i>et al.</i>	(GENO, MILA, SACL)	REFID=20338
EISENBERG	72	NC 9A 1	Y. Eisenberg <i>et al.</i>	(REHO, SLAC, TELA)	REFID=20098
ESPIGAT	72	PR D5 15	P. Espigat <i>et al.</i>	(CERN, CDEF)	REFID=21232
FOLEY	72	NP B36 93	K.J. Foley <i>et al.</i>	(BNL, CUNY)	REFID=21233
ALSTON-...	71	PR D6 747	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21214
BARNHAM	71	PL 34B 156	K.W.J. Barnham <i>et al.</i>	(LBL)	REFID=21215
BINNIE	71	PRL 26 1494	D.M. Binnie <i>et al.</i>	(LOIC, SHMP)	REFID=21217
BOWEN	71	PL 36B 257	D.R. Bowen <i>et al.</i>	(NEAS, STON)	REFID=21219
GRAYER	71	PRL 26 1663	G. Grayer <i>et al.</i>	(CERN, MPIM)	REFID=21223
ABRAMOVI...	70B	PL 34B 333	M. Abramovich <i>et al.</i>	(CERN) JP	REFID=21195
ALSTON-...	70	NP B23 466	M. Alston-Garnjost <i>et al.</i>	(LRL)	REFID=21196
BOECKMANN	70	PL 33B 607	K. Boeckmann <i>et al.</i>	(BONN, DURH, NIJM+)	REFID=21202
ASCOLI	68	NP B16 221	G. Ascoli <i>et al.</i>	(ILL) JP	REFID=21171
BOESEBECK	68	PRL 20 1321	K. Boesebeck <i>et al.</i>	(AACH, BERL, CERN)	REFID=20585
CHUNG	68	NP B4 501	S.U. Chung <i>et al.</i>	(LRL)	REFID=20059
CONTE	67	PR 165 1491	F. Conte <i>et al.</i>	(GENO, HAMB, MILA, SACL)	REFID=21166
	67	NC 51A 175			

$f_0(1370)$

$$J^{PC} = 0^{++}$$

See the review on "Scalar Mesons below 2 GeV" 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 POSITION

Note that $\Gamma \approx 2 \operatorname{Im}(\sqrt{s_{\text{pole}}})$.

NODE=M147PP

NODE=M147PP

NODE=M147PP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(1200–1500)–$i(150\text{--}250)$ OUR ESTIMATE			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1280.6 \pm 1.6 \pm 47.4)$ $-i(205.2 \pm 1.7 \pm 20.7)$	¹ ALBRECHT	20	RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta,$ $\pi^0 \eta \eta, \pi^0 K^+ K^-$
$(1290 \pm 50) - i(170^{+20}_{-40})$	² ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
$(1373 \pm 15) - i(137 \pm 10)$	³ BARGIOTTI	03	OBLX $\bar{p}p$
$(1302 \pm 17) - i(166 \pm 18)$	⁴ BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
$(1312 \pm 25 \pm 10) - i(109 \pm 22 \pm 15)$	BARBERIS	99D	OMEG $450 pp \rightarrow K^+ K^-,$ $\pi^+ \pi^-$
$(1406 \pm 19) - i(80 \pm 6)$	⁵ 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 $450 pp \rightarrow$ $pp2(\pi^+ \pi^-)$
$(1548 \pm 40) - i(560 \pm 40)$	BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
$(1380 \pm 40) - i(180 \pm 25)$	ABELE	96B	CBAR $0.0 \bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
$(1300 \pm 15) - i(115 \pm 8)$	BUGG	96	RVUE
$(1330 \pm 50) - i(150 \pm 40)$	⁶ AMSLER	95B	CBAR $\bar{p}p \rightarrow 3\pi^0$
$(1360 \pm 35) - i(150\text{--}300)$	⁶ AMSLER	95C	CBAR $\bar{p}p \rightarrow \pi^0 \eta \eta$
$(1390 \pm 30) - i(190 \pm 40)$	⁷ AMSLER	95D	CBAR $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta,$ $\pi^0 \pi^0 \eta$
$1346 - i249$	^{8,9} JANSSEN	95	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$1214 - i168$	^{9,10} 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 $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$
$(1340 \pm 40) - i(127^{+30}_{-20})$	¹¹ BUGG	94	RVUE $\bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0,$ $\eta \pi^0 \pi^0$
$(1430 \pm 5) - i(73 \pm 13)$	¹² KAMINSKI	94	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$
$1420 - i220$	¹³ AU	87	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

¹ 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 ($\eta\eta'$).

² Another pole is found at $(1510 \pm 130) - i(800^{+100}_{-150})$ MeV.

³ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.

⁴ Average between $\pi^+ \pi^- 2\pi^0$ and $2(\pi^+ \pi^-)$.

⁵ T-matrix pole on sheet — — —.

⁶ Supersedes ANISOVICH 94.

⁷ 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.

⁸ Analysis of data from FALVARD 88.

⁹ The pole is on Sheet III. Demonstrates explicitly that $f_0(500)$ and $f_0(1370)$ are two different poles.

¹⁰ 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.

¹¹ Reanalysis of ANISOVICH 94 data.

¹² T-matrix pole on sheet III.

¹³ Analysis of data from OCHS 73, GRAYER 74, BECKER 79, and CASON 83.

NODE=M147PP;LINKAGE=E

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NODE=M147PP;LINKAGE=BG

NODE=M147PP;LINKAGE=PC

NODE=M147PP;LINKAGE=TK

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NODE=M147PP;LINKAGE=BB

NODE=M147PP;LINKAGE=C1

NODE=M147PP;LINKAGE=KM

NODE=M147PP;LINKAGE=H

 $f_0(1370)$ BREIT-WIGNER MASS OR K-MATRIX POLE PARAMETER

NODE=M147205

VALUE (MeV)	DOCUMENT ID
1200 to 1500 OUR ESTIMATE	

NODE=M147M
→ UNCHECKED ←

$\pi\pi$ 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+72}_{-7-255}		² UEHARA 08A	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
1259 ± 55	2.6k	BONVICINI 07	CLEO	$D^+ \rightarrow \pi^- \pi^+ \pi^+$
$1309 \pm 1 \pm 15$		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	$J/\psi \rightarrow \phi \pi^+ \pi^-$
$1265 \pm 30^{+20}_{-35}$		ABLIKIM 05Q	BES2	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
$1434 \pm 18 \pm 9$	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	$pp \rightarrow pp \pi\pi, pp K\bar{K}$
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 $\tau^- \rightarrow \pi^- \pi^0 \pi^0 \nu_\tau$ decaysNODE=M147M1
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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. ● ● ●				
$1422 \pm 15 \pm 28$		¹ AAIJ 19H	LHCB	$pp \rightarrow D^\pm X$
$1360 \pm 31 \pm 28$	430	^{2,3} DOBBS 15		$J/\psi \rightarrow \gamma K^+ K^-$
$1350 \pm 48 \pm 15$	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	$23 \pi^- p \rightarrow n 2 K_S^0$
1425 ± 15		WICKLUND 80	SPEC	$6 \pi N \rightarrow K^+ K^- N$
~ 1300		POLYCHRO... 79	STRC	$7 \pi^- p \rightarrow n 2 K_S^0$

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
NODE=M147M2

OCCUR=4

OCCUR=2

NODE=M147M2;LINKAGE=F
NODE=M147M2;LINKAGE=A
NODE=M147M2;LINKAGE=B **4π MODE $2(\pi\pi)_S + \rho\rho$**

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 AOUE 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 $B^\pm \rightarrow \pi^\pm \pi^\pm \pi^\mp$
$90^{+2}_{-1} {}^{+50}_{-22}$		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, CA-SON 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;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 $23 \pi^- p \rightarrow n 2 K_S^0$
160 ± 30	WICKLUND	80	SPEC $6 \pi N \rightarrow K^+ K^- N$
~ 150	POLYCHRO...	79	STRC $7 \pi^- p \rightarrow n 2 K_S^0$

¹ From the $D^\pm \rightarrow K^\pm K^+ K^-$ Dalitz plot fit with the isobar model A.

OCCUR=3

NODE=M147W2;LINKAGE=C

4 π MODE 2($\pi\pi$) $_S$ + $\rho\rho$

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
275 $\pm$ 55		ABELE	01	CBAR 0.0 $\bar{p}d \rightarrow \pi^- 4\pi^0 p$
375 $\pm$ 61		AMSLER	94	CBAR 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- 3\pi^0$
398 $\pm$ 26		ADAMO	93	OBLX $\bar{n}p \rightarrow 3\pi^+ 2\pi^-$
310 $\pm$ 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 $\rho\rho$ dominant.NODE=M147W3
NODE=M147W3

NODE=M147W3;LINKAGE=BE

 $\eta\eta$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
484 $^{+246}_{-170}$ + 246 $^{+246}_{-263}$	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 $\pm$ 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

 $f_0(1370)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 4π	seen
Γ_3 $4\pi^0$	seen
Γ_4 $2\pi^+ 2\pi^-$	seen
Γ_5 $\pi^+ \pi^- 2\pi^0$	seen
Γ_6 $\rho\rho$	seen
Γ_7 $2(\pi\pi)_S$ -wave	seen
Γ_8 $\pi(1300)\pi$	seen
Γ_9 $a_1(1260)\pi$	seen
Γ_{10} $\eta\eta$	seen
Γ_{11} $K\bar{K}$	seen
Γ_{12} $K\bar{K} n\pi$	not seen
Γ_{13} 6π	not seen
Γ_{14} $\omega\omega$	not seen
Γ_{15} $\gamma\gamma$	seen
Γ_{16} $e^+ e^-$	not seen

NODE=M147215;NODE=M147

DESIG=1;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=10;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=4;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=5;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=6;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=14;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=15;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=16;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=17;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=2;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=11;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=18;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=19;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=20;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=12;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=13;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$

 $f_0(1370)$ PARTIAL WIDTHS **$\Gamma(\gamma\gamma)$** See $\gamma\gamma$ widths under $f_0(500)$ and MORGAN 90. **Γ_{15}**

NODE=M147217

NODE=M147W11
NODE=M147W11
NODE=M147W11 **$\Gamma(e^+ e^-)$**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<20	90	VOROBYEV	88	ND $e^+ e^- \rightarrow \pi^0 \pi^0$

 Γ_{16} 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	$0.0 \bar{p}d \rightarrow 5\pi p$

$\Gamma(\rho\rho)/\Gamma(2\pi\pi)_{S\text{-wave}}$ Γ_6/Γ_7

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 $\bar{p}n \rightarrow \text{hadrons}$

NODE=M147R10
 NODE=M147R10

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_8/Γ_2

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 $\bar{p}d \rightarrow 5\pi p$

NODE=M147R18
 NODE=M147R18

 $\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$ Γ_9/Γ_2

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 $\bar{p}d \rightarrow 5\pi p$

NODE=M147R19
 NODE=M147R19

 $\Gamma(\eta\eta)/\Gamma(4\pi)$ $\Gamma_{10}/\Gamma_2 = \Gamma_{10}/(\Gamma_3 + \Gamma_4 + \Gamma_5)$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
(28 ± 11) $\times 10^{-3}$	¹ ANISOVICH	02D	SPEC Combined fit
(4.7 ± 2.0) $\times 10^{-3}$	BARBERIS	00E	450 $p\bar{p} \rightarrow p_f \eta \eta p_s$

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

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.35 ± 0.13	BUGG	96	RVUE

NODE=M147R11
 NODE=M147R11

 $\Gamma(K\bar{K})/\Gamma(\pi\pi)$ Γ_{11}/Γ_1

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 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

NODE=M147R13
 NODE=M147R13

¹ Coupled channel analysis of $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, and $K_S^0 \pi^\mp$.

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

 $\Gamma(K\bar{K}n\pi)/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.03	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$

NODE=M147R20
 NODE=M147R20

 $\Gamma(6\pi)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.22	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$

NODE=M147R21
 NODE=M147R21

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
<0.13	GASPERO	93	DBC 0.0 $\bar{p}n \rightarrow \text{hadrons}$

NODE=M147R22
 NODE=M147R22

$\phi_0(1370)$ REFERENCES

NODE=M147

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		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
JANSSEN	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)	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

$\pi_1(1400)$

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

See the review on "Non- $q\bar{q}$ Mesons" and a note in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M111

NODE=M111

NODE=M111M

NODE=M111M

 $\pi_1(1400)$ MASS

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. • • •					
1404.7 ± 3.5 $^{+15.1}_{-17.7}$		² ALBRECHT	20	RVUE	$0.9 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
1323.1 ± 4.6		³ AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
1406 ±20		⁴ ALDE	88B	GAM4 0	$100 \pi^- p \rightarrow \eta \pi^0 n$

¹ Natural parity exchange, questioned by DZIERBA 03.

² T-matrix pole, 1 pole, 2 channels ($\pi\eta$, $\pi\eta'$ for unitarity).

³ Unnatural parity exchange.

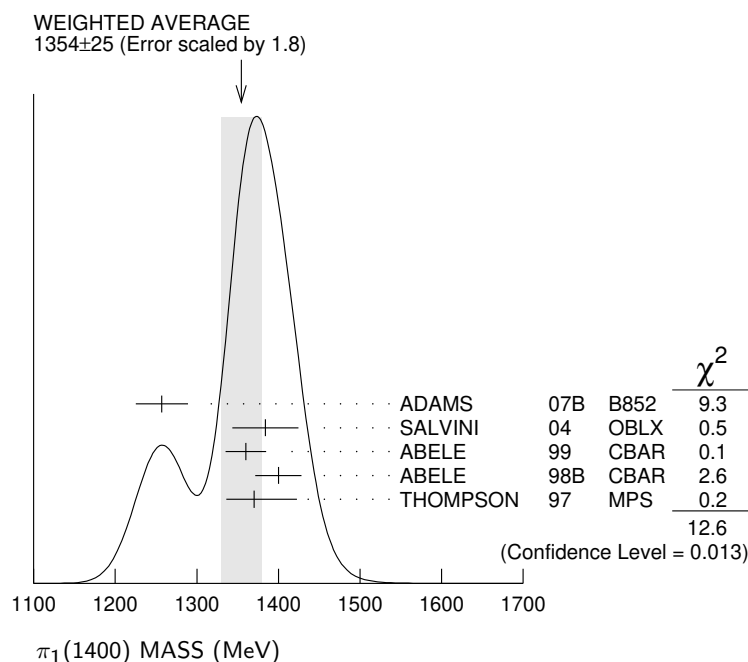
⁴ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M111M;LINKAGE=B

NODE=M111M;LINKAGE=E

NODE=M111M;LINKAGE=C

NODE=M111M;LINKAGE=A

 **$\pi_1(1400)$ WIDTH**

NODE=M111W

NODE=M111W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
330 ±35 OUR AVERAGE					
354 ±64 ±58	23.5k	ADAMS	07B	B852	$18 \pi^- p \rightarrow \eta \pi^0 n$
378 ±50 ±50	90k	SALVINI	04	OBLX	$\bar{p} p \rightarrow 2\pi^+ 2\pi^-$
220 ±90		ABELE	99	CBAR	$0.0 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
310 ±50 $^{+50}_{-30}$		ABELE	98B	CBAR	$0.0 \bar{p} n \rightarrow \pi^- \pi^0 \eta$
385 ±40 $^{+65}_{-105}$		¹ THOMPSON	97	MPS	$18 \pi^- p \rightarrow \eta \pi^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
628.3 ±27.1 $^{+35.8}_{-138.2}$		² ALBRECHT	20	RVUE	$0.9 \bar{p} p \rightarrow \pi^0 \pi^0 \eta$
143.2 ±12.5		³ AOYAGI	93	BKEI	$\pi^- p \rightarrow \eta \pi^- p$
180 ±20		⁴ 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 T-matrix pole, 1 pole, 2 channels ($\pi\eta$, $\pi\eta'$ for unitarity).

³ Unnatural parity exchange.

⁴ Seen in the P_0 -wave intensity of the $\eta\pi^0$ system, unnatural parity exchange.

NODE=M111W;LINKAGE=QQ

NODE=M111W;LINKAGE=B

NODE=M111W;LINKAGE=C

NODE=M111W;LINKAGE=A

NODE=M111215;NODE=M111

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=5

NODE=M111220

NODE=M111R1

NODE=M111R1

NODE=M111R1;LINKAGE=C

NODE=M111R1;LINKAGE=B

NODE=M111R4

NODE=M111R4

NODE=M111R3

NODE=M111R3

NODE=M111R00

NODE=M111R00

NODE=M111

REFID=60439

REFID=59471

REFID=52048

REFID=51004

REFID=53226

REFID=49412

REFID=46602

REFID=45864

REFID=45584

REFID=44619

REFID=44078

REFID=43599

REFID=43598

REFID=41751

REFID=40558

REFID=22913

$\pi_1(1400)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta\pi^0$	seen
$\Gamma_2 \quad \eta\pi^-$	seen
$\Gamma_3 \quad \eta'\pi$	
$\Gamma_4 \quad \rho(770)\pi$	not seen

$\pi_1(1400)$ BRANCHING RATIOS

$\Gamma(\eta\pi^0)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen	PROKOSHKIN 95B	GAM4		$100 \pi^- p \rightarrow \eta\pi^0 n$
not seen	¹ BUGG	94	RVUE	$\bar{p}p \rightarrow \eta 2\pi^0$
not seen	² APEL	81	NICE 0	$40 \pi^- p \rightarrow \eta\pi^0 n$

¹ Using Crystal Barrel data.

² A general fit allowing S , D , and P waves (including $m=0$) is not done because of limited statistics.

$\Gamma(\eta\pi^-)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
possibly seen	BELADIDZE 93	VES	$37\pi^- N \rightarrow \eta\pi^- N$	

$\Gamma(\eta'\pi)/\Gamma(\eta\pi^0)$				Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.80	95	BOUTEMEUR 90	GAM4	$100 \pi^- p \rightarrow 4\gamma n$

$\Gamma(\rho(770)\pi)/\Gamma_{\text{total}}$				Γ_4/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
not seen	AGHASYAN 18B	COMP	$190 \pi^- p \rightarrow \pi^- \pi^+ \pi^- p$	

$\pi_1(1400)$ REFERENCES

ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
AGHASYAN 18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADAMS 07B	PL B657 27	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)
PDG 06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
SALVINI 04	EPJ C35 21	P. Salvini <i>et al.</i>	(OBELIX Collab.)
DZIERBA 03	PR D67 094015	A.R. Dzierba <i>et al.</i>	
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.)
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)
	Translated from YAF 58 662.		
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.)
BELADIDZE 93	PL B313 276	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BOUTEMEUR 90	Hadron 89 Conf. p 119	M. BoutemEUR, M. Poulet	(SERP, BELG, LANL+)
ALDE 88B	PL B205 397	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP) IGJPC
APEL 81	NP B193 269	W.D. Apel <i>et al.</i>	(SERP, CERN)

$\eta(1405)$

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

See also the $\eta(1475)$.

See the related review(s):

Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region

NODE=M027

NODE=M027

 $\eta(1405)$ MASS

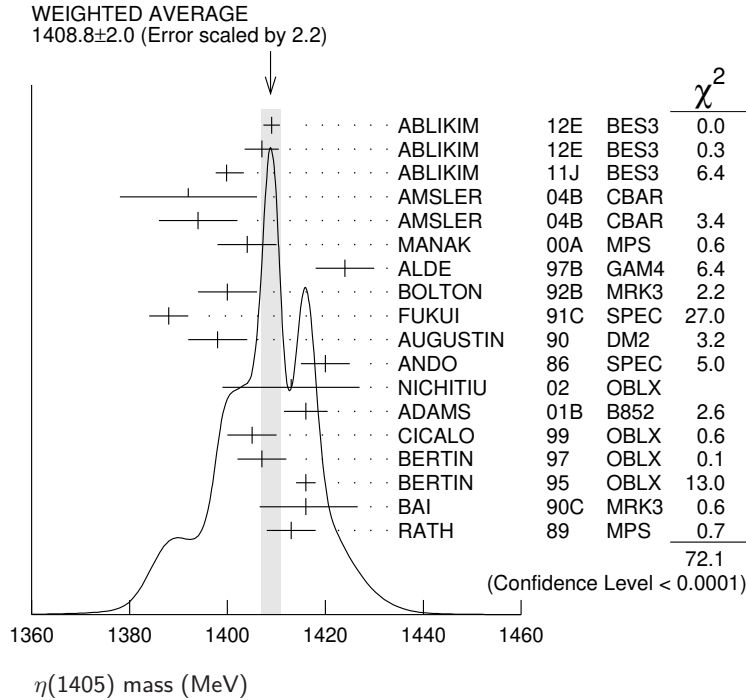
NODE=M027205

NODE=M027MX

VALUE (MeV)

DOCUMENT ID

1408.8 $\pm$ 2.0 OUR AVERAGE Includes data from the 2 datablocks that follow this one.
Error includes scale factor of 2.2. See the ideogram below.

 **$\eta\pi\pi$ MODE**

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M027M1

NODE=M027M1

1405.8 $\pm$ 2.6 OUR AVERAGE Error includes scale factor of 2.3. See the ideogram below.

1409.0 $\pm$ 1.7	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^0)$	
1407.0 $\pm$ 3.5	198	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^0\pi^0\pi^0)$	OCCUR=2
1399.8 $\pm$ 2.2 $^{+2.8}_{-0.1}$	1	ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$	
1392 $\pm$ 14	900 $\pm$ 375	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-\eta$	
1394 $\pm$ 8	6.6 $\pm$ 2.0k	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$	OCCUR=2
1404 $\pm$ 6	9082	MANAK	00A MPS	$18 \pi^-p \rightarrow \eta\pi^+\pi^-n$	
1424 $\pm$ 6	2200	ALDE	97B GAM4	$100 \pi^-p \rightarrow \eta\pi^0\pi^0n$	
1400 $\pm$ 6		2 BOLTON	92B MRK3	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1388 $\pm$ 4		FUKUI	91C SPEC	$8.95 \pi^-p \rightarrow \eta\pi^+\pi^-n$	
1398 $\pm$ 6	261	3 AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1420 $\pm$ 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 $\pm$ 11.0	195	ABLIKIM	19BABES3	$e^+e^- \rightarrow \psi(2S)$	
1385 $\pm$ 7		BAI	99 BES	$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$	
1409 $\pm$ 3	4	AMSLER	95F CBAR	$0 \bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$	

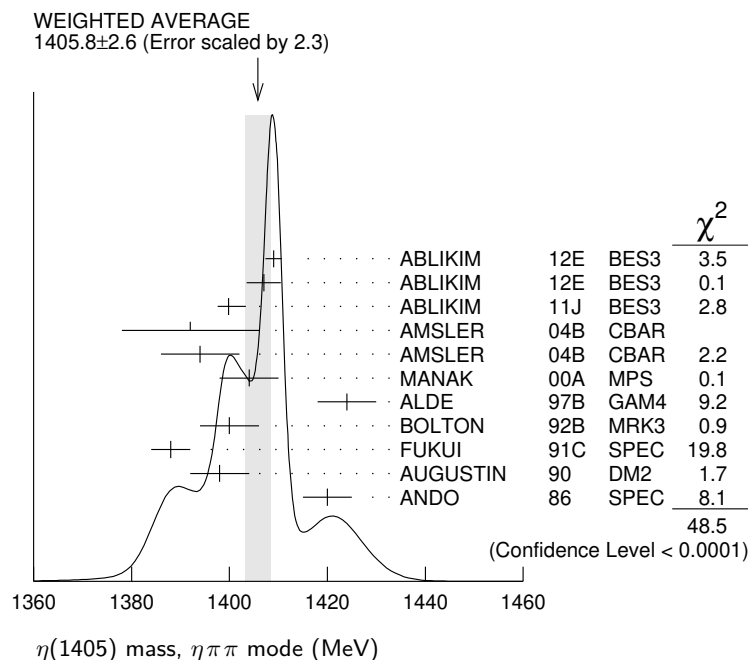
¹ The selected process is $J/\psi \rightarrow \omega a_0(980)\pi$.² From fit to the $a_0(980)\pi 0^-+$ partial wave.³ Best fit with a single Breit Wigner.⁴ Superseded by AMSLER 04B.

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.

1413.9± 1.7 OUR AVERAGE Error includes scale factor of 1.1.

1413 ± 14	3651	¹ NICHITIU	02 OBLX	0 $\bar{p}p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1416 ± 4 ± 2	20k	ADAMS	01B B852	18 GeV $\pi^- p \rightarrow K^+ K^- \pi^0 n$
1405 ± 5		² CICALO	99 OBLX	0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp \pi^+ \pi^-$
1407 ± 5		² BERTIN	97 OBLX	0 $\bar{p}p \rightarrow K^\pm (K^0) \pi^\mp \pi^+ \pi^-$
1416 ± 2		² BERTIN	95 OBLX	0 $\bar{p}p \rightarrow K\bar{K}\pi\pi\pi$
1416 ± 8 $\begin{smallmatrix} +7 \\ -5 \end{smallmatrix}$	700	³ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
1413 ± 5		³ RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

NODE=M027M4
NODE=M027M4

OCCUR=2

OCCUR=3

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

1459 ± 5		⁴ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$

¹ Decaying dominantly directly to $K^+ K^- \pi^0$.

² Decaying into $(K\bar{K})_S \pi$, $(K\pi)_S \bar{K}$, and $a_0(980)\pi$.

³ From fit to the $a_0(980)\pi 0^- +$ partial wave. Cannot rule out a $a_0(980)\pi 1^+ +$ partial wave.

⁴ Excluded from averaging because averaging would be meaningless.

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	$J/\psi \rightarrow \pi^+ \pi^- 2\gamma$

OCCUR=4

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;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	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + \text{c.c.}$
1445.9 ± 5.7	62 ± 18	^{1,2} ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^+ K^- \pi^0$
1442 ± 10	410	¹ BAI	98C BES	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
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	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
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	$8 \pi^- p \rightarrow K^+ \bar{K}^0 \pi^- n$
1424 ± 3	620	¹ REEVES	86 SPEC	$6.6 p \bar{p} \rightarrow K \bar{K} \pi X$
1421 ± 2		¹ CHUNG	85 SPEC	$8 \pi^- p \rightarrow K \bar{K} \pi n$
1440^{+20}_{-15}	174	¹ EDWARDS	82E CBAL	$J/\psi \rightarrow \gamma K^+ K^- \pi^0$
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

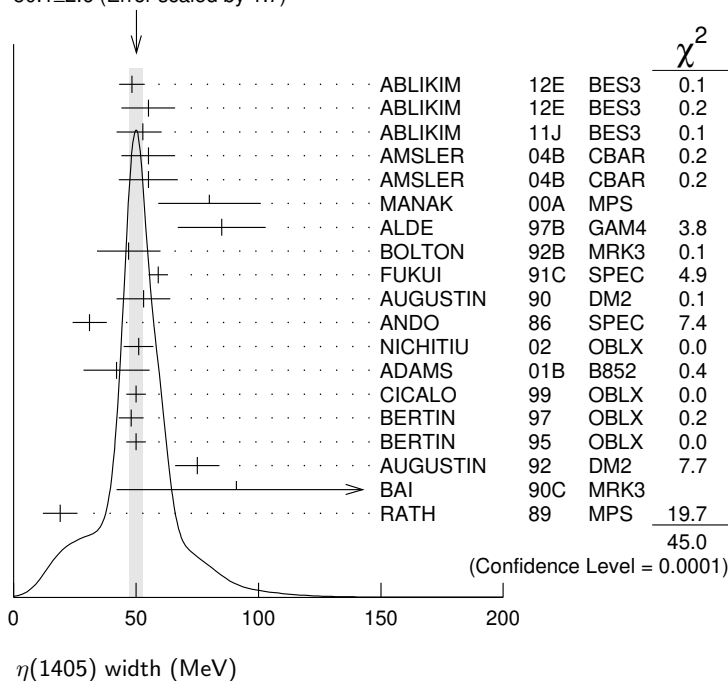
 $\eta(1405)$ WIDTH

NODE=M027210

VALUE (MeV) DOCUMENT ID
50.1 $\pm$ 2.6 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.7. See the ideogram below.

NODE=M027WX

WEIGHTED AVERAGE
50.1 $\pm$ 2.6 (Error scaled by 1.7)

 **$\eta\pi\pi$ 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 ± 5.2	743	ABLIKIM	12E BES3	$J/\psi \rightarrow \gamma(\pi^+ \pi^- \pi^0)$
55.0 ± 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 ± 11	900	AMSLER	04B CBAR	$0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^+ \pi^- \eta$

OCCUR=2

55 ±12	6.6k	AMSLER	04B CBAR	$0 \bar{p} p \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \gamma$
80 ±21	9.0k	MANAK	00A MPS	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
85 ±18	2.2k	ALDE	97B GAM4	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$
47 ±13		² BOLTON	92B MRK3	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
59 ± 4		FUKUI	91C SPEC	$8.95 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
53 ±11		³ AUGUSTIN	90 DM2	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
31 ± 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±16.0	195	ABLIKIM	19BA BES3	$e^+ e^- \rightarrow \psi(2S)$
86 ±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 $a_0(980) \pi^0 \pi^+$ 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

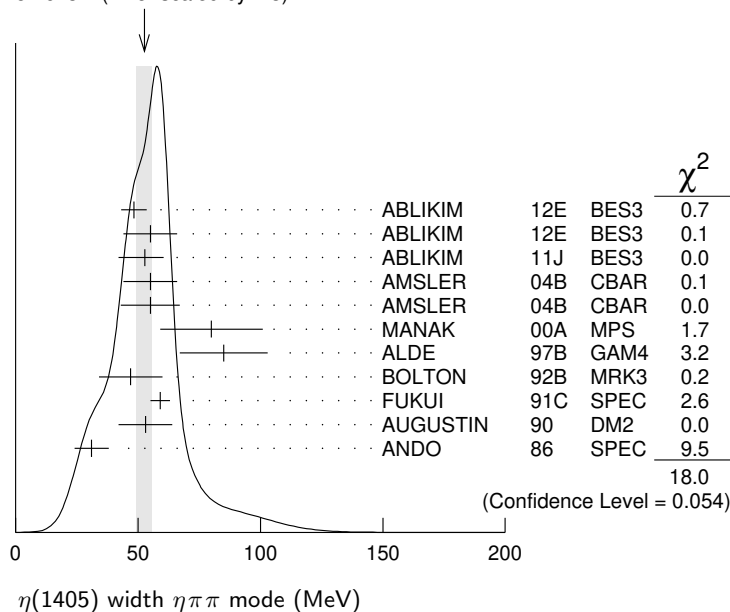
NODE=M027W1;LINKAGE=BL

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.

48 ± 4 OUR AVERAGE Error includes scale factor of 2.1. See the ideogram below.

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⁺¹⁵ -31-38		³ BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
19 ± 7		³ RATH	89 MPS	$21.4 \pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

¹ Decaying dominantly directly to $K^+ K^- \pi^0$.

² Decaying into $(K \bar{K})_S \pi$, $(K \pi)_S \bar{K}$, and $a_0(980) \pi$.

³ From fit to the $a_0(980) \pi^0 \pi^+$ partial wave, but $a_0(980) \pi^+ \pi^+$ cannot be excluded.

NODE=M027W4

NODE=M027W4

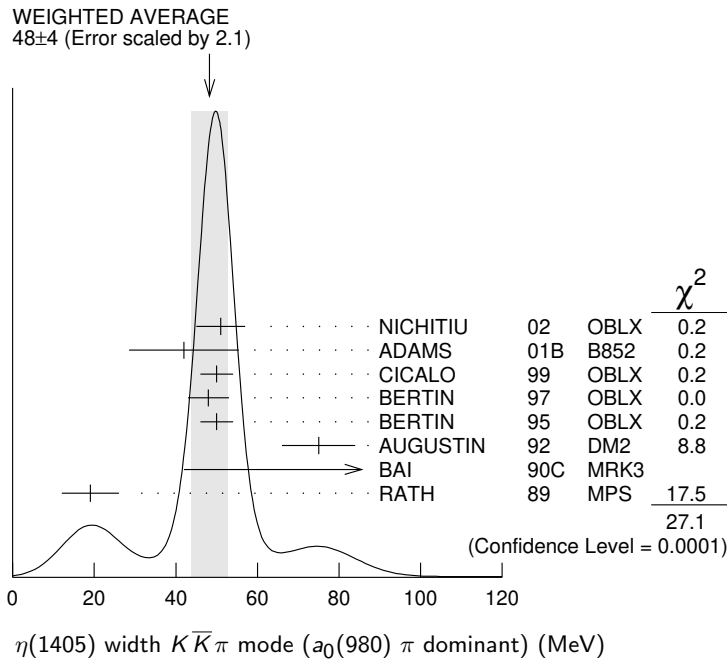
OCCUR=2

OCCUR=3

NODE=M027W;LINKAGE=NC

NODE=M027W4;LINKAGE=FX

NODE=M027W4;LINKAGE=C



ππγ 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
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
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	$J/\psi \rightarrow \omega K_S^0 K^+ \pi^- + c.c.$
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

NODE=M027215;NODE=M027

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-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	

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 EST;→ UNCHECKED ←
 DESIG=12
 DESIG=7
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=13
 DESIG=11;OUR EST;→ UNCHECKED ←

 $\eta(1405) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M027220

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_9/\Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	

NODE=M027G3
 NODE=M027G3

• • • 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=M027G3;LINKAGE=AH
 NODE=M027G3;LINKAGE=B3

$\Gamma(\eta\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_9/\Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	

NODE=M027G5
 NODE=M027G5

<0.095 95 ACCIARRI 01G L3 183–202 $e^+e^- \rightarrow e^+e^- \eta\pi^+\pi^-$

$\Gamma(\rho^0\gamma) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_9/\Gamma$
VALUE (keV) CL% DOCUMENT ID TECN COMMENT	

NODE=M027G8
 NODE=M027G8

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

<1.5 95 ALTHOFF 84E TASS $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\gamma$

 $\eta(1405)$ BRANCHING RATIOS

NODE=M027225

$\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$	Γ_2/Γ_1
VALUE CL% DOCUMENT ID TECN COMMENT	

NODE=M027R3
 NODE=M027R3

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 $\bar{p}p$

¹ Using the data of BAILLON 67 on $\bar{p}p \rightarrow K\bar{K}\pi$.

NODE=M027R3;LINKAGE=AM

$\Gamma(\rho^0\gamma)/\Gamma(\eta\pi\pi)$	Γ_{10}/Γ_2
VALUE DOCUMENT ID TECN COMMENT	

NODE=M027R12
 NODE=M027R12

0.111±0.064 AMSLER 04B CBAR 0 $\bar{p}p$

$\Gamma(a_0(980)\pi)/\Gamma(K\bar{K}\pi)$	Γ_3/Γ_1
VALUE EVTS DOCUMENT ID TECN COMMENT	

NODE=M027R4
 NODE=M027R4

• • • 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 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^\mp K^0$

~0.75 ¹ REEVES 86 SPEC 6.6 $p\bar{p} \rightarrow K K\pi X$

¹ Assuming that the $a_0(980)$ decays only into $K\bar{K}$.

NODE=M027R4;LINKAGE=C

$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$	Γ_3/Γ_2
VALUE EVTS DOCUMENT ID TECN COMMENT	

NODE=M027R2
 NODE=M027R2

• • • 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 $\pi^-\pi^+ \rightarrow \eta\pi^0\pi^0\pi^0$

0.56±0.04±0.03 ¹ AMSLER 95F CBAR 0 $\bar{p}p \rightarrow \pi^+\pi^-\pi^0\pi^0\eta$

¹ Assuming that the $a_0(980)$ decays only into $\eta\pi$.

NODE=M027R2;LINKAGE=A

$\Gamma(a_0(980)\pi)/\Gamma(\eta(\pi\pi)S\text{-wave})$ Γ_3/Γ_4

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	$18 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
$0.70 \pm 0.12 \pm 0.20$		² BAI	99	BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

¹ Statistical error only.² Assuming that the $a_0(980)$ decays only into $\eta\pi$.NODE=M027R9
NODE=M027R9NODE=M027R;LINKAGE=K3
NODE=M027R9;LINKAGE=BK $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$ Γ_{10}/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT

0.0152 ± 0.0038 ¹ COFFMAN 90 MRK3 $J/\psi \rightarrow \gamma \gamma \pi^+ \pi^-$ 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
NODE=M027R7

NODE=M027R7;LINKAGE=D

 $\Gamma(\gamma\gamma)/\Gamma(K\bar{K}\pi)$ Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 1.78 × 10⁻³ 90 ¹ ABLIKIM 180 BES3 $\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$ ¹ Using results from BAI 00D.NODE=M027R02
NODE=M027R02

NODE=M027R02;LINKAGE=A

 $\Gamma(\eta(\pi\pi)S\text{-wave})/\Gamma(\eta\pi\pi)$ Γ_4/Γ_2

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	$100 \pi^- p \rightarrow \eta \pi^0 \pi^0 n$

NODE=M027R8
NODE=M027R8 $\Gamma(f_0(980)\eta)/\Gamma(\eta\pi\pi)$ Γ_6/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT

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

 0.32 ± 0.07 ¹ ANISOVICH 00 SPEC $0.9\text{--}1.2 \bar{p}p \rightarrow \eta 3\pi^0$ 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=M027R13NODE=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

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

 0.084 ± 0.024 ¹ ADAMS 01B B852 $18 \text{ GeV } \pi^- p \rightarrow K^+ K^- \pi^0 n$ 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

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

 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	19BA	PR D100 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60024
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
ABLIKIM	17AJ	PR D96 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58322
ABLIKIM	13M	PR D87 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55386
ABLIKIM	12E	PRL 108 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=54270
ABLIKIM	11J	PRL 107 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=53931
ABLIKIM	08E	PR D77 032005	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52143
AHOHE	05	PR D71 072001	R. Ahohe <i>et al.</i>	(CLEO Collab.)	REFID=50764
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
NICHITIU	02	PL B545 261	F. Nichitiu <i>et al.</i>	(OBELIX Collab.)	REFID=48848
ACCIARRI	01G	PL B501 1	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48319
ADAMS	01B	PL B516 264	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)	REFID=49649
ANISOVICH	01	NP A690 567	A.V. Anisovich <i>et al.</i>		REFID=48308
ANISOVICH	00	PL B472 168	A.V. Anisovich <i>et al.</i>		REFID=47429
BAI	00D	PL B476 25	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=47954
MANAK	00A	PR D62 012003	J.J. Manak <i>et al.</i>	(BNL E852 Collab.)	REFID=47989
BAI	99	PL B446 356	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46606
CICALO	99	PL B462 453	C. Cicalo <i>et al.</i>	(OBELIX Collab.)	REFID=47394
ABELE	98E	NP B514 45	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46314
BAI	98C	PL B440 217	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=46337
ALDE	97B	PAN 60 386	D. Alde <i>et al.</i>	(GAMS Collab.)	REFID=45396
		Translated from YAF 60 458.			
BERTIN	97	PL B400 226	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45417
AMSLER	95F	PL B358 389	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=44613
BERTIN	95	PL B361 187	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=44614
BUGG	95	PL B353 378	D.V. Bugg <i>et al.</i>	(LOQM, PNPI, WASH)	REFID=44438
AUGUSTIN	92	PR D46 1951	J.E. Augustin, G. Cosme	(DM2 Collab.)	REFID=41584
BOLTON	92B	PRL 69 1328	T. Bolton <i>et al.</i>	(Mark III Collab.)	REFID=42176
FUKUI	91C	PL B267 293	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41748
AUGUSTIN	90	PR D42 10	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=41352
BAI	90C	PRL 65 2507	Z. Bai <i>et al.</i>	(Mark III Collab.)	REFID=41578
COFFMAN	90	PR D41 1410	D.M. Coffman <i>et al.</i>	(Mark III Collab.)	REFID=41350
BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i>	(DM2 Collab.)	REFID=40575
DUCH	89	ZPHY C45 223	K.D. Duch <i>et al.</i>	(ASTERIX Collab.) JP	REFID=41016
RATH	89	PR D40 693	M.G. Rath <i>et al.</i>	(NDAM, BRAN, BNL, CUNY+)	REFID=40924
BIRMAN	88	PRL 61 1557	A. Birman <i>et al.</i>	(BNL, FSU, IND, MASD) JP	REFID=40568
ANDO	86	PRL 57 1296	A. Ando <i>et al.</i>	(KEK, KYOT, NIRS, SAGA+) IJP	REFID=20891
REEVES	86	PR D34 1960	D.F. Reeves <i>et al.</i>	(FLOR, BNL, IND+) JP	REFID=20936
CHUNG	85	PRL 55 779	S.U. Chung <i>et al.</i>	(BNL, FLOR, IND+) JP	REFID=20934
ALTHOFF	84E	PL 147B 487	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=20305
EDWARDS	83B	PRL 51 859	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21318
EDWARDS	82E	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
Also		PRL 50 219	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21315
SCHARRE	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
FOSTER	68B	NP B8 174	M. Foster <i>et al.</i>	(CERN, CDEF)	REFID=21179
BAILLON	67	NC 50A 393	P.H. Baillon <i>et al.</i>	(CERN, CDEF, IRAD)	REFID=20407

NODE=M109

 $h_1(1415)$

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

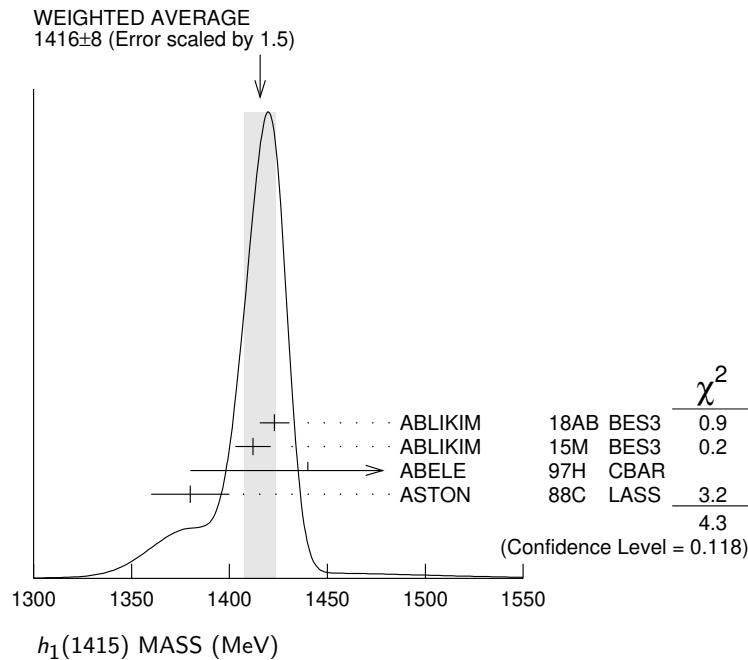
was $h_1(1380)$ **$h_1(1415)$ MASS**

NODE=M109M

NODE=M109M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1416 ± 8	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
$1423 \pm 2.1 \pm 7.3$	2.2k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
$1412 \pm 4 \pm 8$		¹ 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 Final states $K^+ K^- \pi^0$ and $K_S^0 K^\pm \pi^\mp$.				

NODE=M109M;LINKAGE=A

 **$h_1(1415)$ WIDTH**

NODE=M109W

NODE=M109W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
90 ± 15	OUR AVERAGE			
$90.3 \pm 9.8 \pm 17.5$	2.2k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
$84 \pm 12 \pm 40$		¹ 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 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
$\Gamma_1 K \bar{K}^*(892) + \text{c.c.}$

DESIG=1

 $h_1(1415)$ REFERENCES

NODE=M109

ABLIKIM 18AB PR D98 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59456
ABLIKIM 15M PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56778
ABELE 97H PL B415 280	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45765
ASTON 88C PL B201 573	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40282

NODE=M230

$a_1(1420)$

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

OMITTED FROM SUMMARY TABLE

$a_1(1420)$ MASS

NODE=M230M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1411^{+4}_{-5}	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. • • •				
1414^{+15}_{-13}		^{2,3} ADOLPH	15C	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
¹ Statistical error negligible.				
² Using the isobar model and partial-wave analysis with 88 waves.				
³ Superseded by AGHASYAN 2018B.				

NODE=M230M

NODE=M230M;LINKAGE=C
NODE=M230M;LINKAGE=A
NODE=M230M;LINKAGE=B

$a_1(1420)$ WIDTH

NODE=M230W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
161^{+11}_{-14}	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. • • •				
153^{+8}_{-23}		^{2,3} ADOLPH	15C	COMP 190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
¹ Statistical error negligible.				
² Using the isobar model and partial-wave analysis with 88 waves.				
³ Superseded by AGHASYAN 2018B.				

NODE=M230W

NODE=M230W;LINKAGE=D
NODE=M230W;LINKAGE=A
NODE=M230W;LINKAGE=C

$a_1(1420)$ DECAY MODES

NODE=M230215;NODE=M230

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad f_0(980)\pi$	seen

DESIG=1

$a_1(1420)$ BRANCHING RATIOS

NODE=M230220

$\Gamma(f_0(980)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
seen	¹ ADOLPH	15C	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$	
¹ Using the isobar model and partial-wave analysis with 88 waves.					

NODE=M230R01
NODE=M230R01

NODE=M230R01;LINKAGE=A

$a_1(1420)$ REFERENCES

NODE=M230

AGHASYAN	18B	PR D98 092003	M. Aghasyan <i>et al.</i>	(COMPASS Collab.)
ADOLPH	15C	PRL 115 082001	C. Adolph <i>et al.</i>	(COMPASS Collab.)

REFID=59471
REFID=56790

$f_1(1420)$

$$J^{PC} = 0^+(1^{++})$$

See the review on "Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region."

NODE=M006

NODE=M006

NODE=M006M2

NODE=M006M2

 $f_1(1420)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1426.3 ± 0.9 OUR AVERAGE		Error includes scale factor of 1.1.		
1434 ± 5 ± 5	133	¹ ACHARD	07 L3	183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
1426 ± 6	711	ABDALLAH	03H DLPH	91.2 $e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp + X$
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 GeV $\pi^-p \rightarrow K^+K^-\pi^0 n$
1426 ± 1		BARBERIS	97C OMEG	450 $pp \rightarrow pp K_S^0 K^\pm \pi^\mp$
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 $\pi^+p, pp \rightarrow \pi^+p, pp(K\bar{K}\pi)$
1462 ± 20		³ AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K\bar{K}\pi$
1443 $\begin{smallmatrix} +7 \\ -6 \end{smallmatrix}$ $\begin{smallmatrix} +3 \\ -2 \end{smallmatrix}$	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 $\begin{smallmatrix} +10 \\ -17 \end{smallmatrix}$	111	BECKER	87 MRK3	$e^+e^- \rightarrow \omega K\bar{K}\pi$
1423 ± 4		GIDAL	87B MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
1417 ± 13	13	AIHARA	86C TPC	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
1422 ± 3		CHAUVAT	84 SPEC	ISR 31.5 pp
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	1.6-4.2 π^-p
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1430.8 ± 0.9		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}}(K_S^0 K^+ \pi^-) p_{\text{fast}}$
1433.4 ± 0.8		⁵ SOSA	99 SPEC	$pp \rightarrow p_{\text{slow}}(K_S^0 K^- \pi^+) p_{\text{fast}}$
1435 ± 9		PROKOSHKIN	97B GAM4	100 $\pi^-p \rightarrow \eta\pi^0\pi^0 n$
1429 ± 3	389	ARMSTRONG	89 OMEG	300 $pp \rightarrow K\bar{K}\pi pp$
1425 ± 2	1520	ARMSTRONG	84 OMEG	85 $\pi^+p, pp \rightarrow (\pi^+, p)(K\bar{K}\pi)p$
~ 1420		BITYUKOV	84 SPEC	32 $K^-p \rightarrow K^+K^-\pi^0 Y$

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
54.5 ± 2.6 OUR AVERAGE				
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 $\bar{p}p \rightarrow K^\pm(K^0)\pi^\mp\pi^+\pi^-$

NODE=M006W

NODE=M006W

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		CHAUVAT	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 $\pi^- p$
• • • 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 $K^- p \rightarrow K^+ K^- \pi^0 \gamma$

⁶ This result supersedes ARMSTRONG 84, ARMSTRONG 89.

⁷ From fit to the $K^*(892)K 1^{++}$ partial wave.

⁸ No systematic error given.

OCCUR=2

NODE=M006W;LINKAGE=C
 NODE=M006W;LINKAGE=B
 NODE=M006W;LINKAGE=N1

$f_1(1420)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\bar{K}\pi$	seen
Γ_2 $K\bar{K}^*(892)+$ 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

NODE=M006215;NODE=M006

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

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma^*)/\Gamma_{\text{total}}$

NODE=M006G2
 NODE=M006G2

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	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<8.0	95		JENNI	83 MRK2	$e^+e^- \rightarrow e^+e^- K\bar{K}\pi$

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

NODE=M006225

 $\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(K\bar{K}\pi)$ **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=M006R1
NODE=M006R1 **$\Gamma(\pi\pi\rho)/\Gamma(K\bar{K}\pi)$** **$\Gamma_5/\Gamma_1$**

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 **$\Gamma(\eta\pi\pi)/\Gamma(K\bar{K}\pi)$** **$\Gamma_3/\Gamma_1$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<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 **$\Gamma(a_0(980)\pi)/\Gamma(\eta\pi\pi)$** **$\Gamma_4/\Gamma_3$**

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 **$\Gamma(4\pi)/\Gamma(K\bar{K}^*(892)+c.c.)$** **$\Gamma_6/\Gamma_2$**

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 $4 \pi^- p$
¹⁴ Calculated using $\Gamma(K\bar{K})/\Gamma(\eta\pi) = 0.24 \pm 0.07$ for $a_0(980)$ fractions.			

NODE=M006R6
NODE=M006R6

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
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.04 \pm 0.01 \pm 0.01$		BARBERIS	98C	OMEG $450 p p \rightarrow p_f f_1(1420) p_s$
<0.04	68	ARMSTRONG	84	OMEG $85 \pi^+ p$

NODE=M006R7
NODE=M006R7 **$\Gamma(4\pi)/\Gamma(K\bar{K}\pi)$** **$\Gamma_6/\Gamma_1$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.62	95	ARMSTRONG	89G	OMEG $85 \pi p \rightarrow 4\pi X$

NODE=M006R8
NODE=M006R8 **$\Gamma(\rho^0\gamma)/\Gamma_{\text{total}}$** **$\Gamma_7/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.08	95	¹⁵ ARMSTRONG	92C	SPEC $300 p p \rightarrow p p \pi^+ \pi^- \gamma$
¹⁵ Using the data on the $\bar{K} K \pi$ mode from ARMSTRONG 89.				

NODE=M006R9
NODE=M006R9

NODE=M006R9;LINKAGE=A

 $\Gamma(\rho^0\gamma)/\Gamma(K\bar{K}\pi)$ **Γ_7/Γ_1**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.02	95	BARBERIS	98C	OMEG $450 p p \rightarrow p_f f_1(1420) p_s$

NODE=M006R10
NODE=M006R10

$\Gamma(\phi\gamma)/\Gamma(K\bar{K}\pi)$ Γ_8/Γ_1

VALUE	DOCUMENT ID	TECN	COMMENT
0.003±0.001±0.001	BARBERIS	98C OMEG	450 $p\bar{p} \rightarrow p_f \bar{f}_1(1420) p_S$

NODE=M006R11
 NODE=M006R11

 $f_1(1420)$ REFERENCES

NODE=M006

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. Sadovskiy		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

NODE=M125

 $\omega(1420)$

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

See also the $\omega(1650)$ particle listing.

NODE=M125

 $\omega(1420)$ MASS

NODE=M125M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1410± 60 OUR ESTIMATE

NODE=M125M
 → UNCHECKED ←

• • • 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 $p\bar{p} \rightarrow \omega\pi^0\pi^0\pi^0$
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 $e^+e^- \rightarrow \rho\pi$

OCCUR=2

OCCUR=3

- 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 $\omega(1650)$.
- 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.

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)	EVS	DOCUMENT ID	TECN	COMMENT

290±190 OUR ESTIMATE

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

104± 35± 10	824	¹ AKHMETSHIN 17A	CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
880±170	13.1k	² AULCHENKO 15A	SND	1.05–1.80 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
480±180		³ 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	⁴ ACHASOV 03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
199± 15		⁵ HENNER 02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$
188± 45	177	⁶ 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		⁷ CLEGG 94	RVUE	
174± 59	315	⁸ 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 $\omega(1650)$.
- ³ 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.
- ⁴ 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.
- ⁵ Using results of CORDIER 81 and preliminary data of DOLINSKY 91 and ANTONELLI 92.
- ⁶ 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.
- ⁷ From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.
- ⁸ From a fit to two Breit-Wigner functions interfering between them and with the ω, ϕ tails with fixed (+, -, +) phases.

NODE=M125W

NODE=M125W
→ UNCHECKED ←

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

$\omega(1420)$ 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 $\pi^0\gamma$	

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

$\omega(1420) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M125230

$$\frac{\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}}{\Gamma_1/\Gamma \times \Gamma_5/\Gamma}$$

 NODE=M125G3
 NODE=M125G3

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 $\omega(1650)$.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.
 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

$$\frac{\Gamma(\omega\pi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}}{\Gamma_2/\Gamma \times \Gamma_5/\Gamma}$$

 NODE=M125G4
 NODE=M125G4

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=M125G;LINKAGE=KL

$$\frac{\Gamma(\omega\eta)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}}{\Gamma_3/\Gamma \times \Gamma_5/\Gamma}$$

 NODE=M125G6
 NODE=M125G6

VALUE (units 10^{-8})	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.1^{+1.0}_{-0.8}$		ACHASOV	19 SND	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \eta$
$5.0 \pm 2.6 \pm 0.3$	824	¹ AKHMETSHIN 17A	CMD3	$1.4-2.0 e^+ e^- \rightarrow \omega\eta$
$1.6^{+0.9}_{-0.7}$	898	² ACHASOV	16B SND	$1.34-2.00 e^+ e^- \rightarrow \omega\eta$

¹ 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.² 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=B

NODE=M125G6;LINKAGE=A

$$\frac{\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}}{\Gamma_6/\Gamma \times \Gamma_5/\Gamma}$$

 NODE=M125G5
 NODE=M125G5

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

$$\frac{\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}}{\Gamma_2/\Gamma}$$

 NODE=M125R2
 NODE=M125R2

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.301 ± 0.029 possibly seen	¹ HENNER	02 RVUE	$1.2-2.0 e^+ e^- \rightarrow \rho\pi, \omega\pi\pi$
	AKHMETSHIN 00D	CMD2	$e^+ e^- \rightarrow \omega \pi^+ \pi^-$

$\Gamma(\omega\pi\pi)/\Gamma(b_1(1235)\pi)$ Γ_2/Γ_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

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.699±0.029	¹ HENNER	02	RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

NODE=M125R3
 NODE=M125R3

 $\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_5/Γ

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 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

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=M125R4
 NODE=M125R4

NODE=M125R;LINKAGE=AC
 NODE=M125R;LINKAGE=AW
 NODE=M125R;LINKAGE=GS

 $\omega(1420)$ REFERENCES

NODE=M125

ACHASOV	19	PR D99 112004	M.N. Achasov <i>et al.</i>	(SND 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)

REFID=59887
 REFID=58239
 REFID=57537
 REFID=56843

REFID=55687
 REFID=59494
 REFID=52049
 REFID=50330
 REFID=50184
 REFID=49577
 REFID=48815
 REFID=49177
 REFID=48311
 REFID=47935
 REFID=47948
 REFID=47391
 REFID=46323
 REFID=44081
 REFID=43168
 REFID=41369
 REFID=40581
 REFID=40280

REFID=21586
 REFID=20553

$f_2(1430)$

$I^G(J^{PC}) = 0^+(2^{++})$

NODE=M066

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			
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
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	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
¹ $J^{PC} = 0^{++}$ or 2^{++} .			
² Not seen by WETZEL 76.			

NODE=M066M1
→ UNCHECKED ←

OCCUR=2

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. ● ● ●			
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	$5,7,12 \pi^- p \rightarrow K_S^0 K_S^0 n$
³ $J^{PC} = 0^{++}$ or 2^{++} .			
⁴ Not seen by WETZEL 76.			

NODE=M066W1

OCCUR=2

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

NODE=M066

VLADIMIRSK... 01	PAN 64 1895 Translated from YAF 64 1979.	V.V. Vladmirsky <i>et al.</i>
AUGUSTIN 87	ZPHY C36 369	J.E. Augustin <i>et al.</i>
AKESSON 86	NP B264 154	T. Akesson <i>et al.</i>
DAUM 84	ZPHY C23 339	C. Daum <i>et al.</i>
WETZEL 76	NP B115 208	W. Wetzels <i>et al.</i>
BEUSCH 67	PL 25B 357	W. Beusch <i>et al.</i>

REFID=48571
REFID=40268
REFID=21123
REFID=21372
REFID=20362
REFID=20320

$a_0(1450)$

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

See the review on "Scalar Mesons below 2 GeV."

NODE=M149

NODE=M149

NODE=M149M

NODE=M149M

 $a_0(1450)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1474 ±19 OUR AVERAGE				
1480 ±30		ABELE 98	CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
1470 ±25		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. • • •				
1302.1 ± 1.1 ± 3.9		² ALBRECHT 20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
1458 ±14 ±15 190k		³ AAIJ 16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1515 ±30		⁴ ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
1316.8 ⁺ _{-1.0} ^{0.7+24.7} _{-4.6}		⁵ UEHARA 09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
1432 ±13 ±25		⁶ BUGG 08A	RVUE	$\bar{p}p$
1477 ±10 80k		⁷ UMAN 06	E835	5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
1441 ⁺ ₋₁₅ 35k		⁴ BAKER 03	SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
1303 ±16		⁸ BARGIOTTI 03	OBLX	$\bar{p}p$
1296 ±10		⁹ AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1565 ±30		⁹ ANISOVICH 98B	RVUE	Compilation
1290 ±10		¹⁰ BERTIN 98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
1450 ±40		AMSLER 94D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
1410 ±25		ETKIN 82C	MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
~ 1300		MARTIN 78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
1255 ± 5		¹¹ CASON 76		

¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.² T-matrix pole, 2 poles, 2 channels ($\pi \eta, K \bar{K}$).³ Using a model with Gaussian constraints to the PDG averaged values.⁴ From the pole position.⁵ May be a different state.⁶ Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.⁷ Statistical error only.⁸ Coupled channel analysis of $\pi^+ \pi^- \pi^0, K^+ K^- \pi^0$, and $K^\pm K_S^0 \pi^\mp$.⁹ T-matrix pole.¹⁰ Not confirmed by BUGG 08A.¹¹ Isospin 0 not excluded.

NODE=M149M;LINKAGE=AB

NODE=M149M;LINKAGE=C

NODE=M149M;LINKAGE=A

NODE=M149M;LINKAGE=PP

NODE=M149M;LINKAGE=UE

NODE=M149M;LINKAGE=BU

NODE=M149M;LINKAGE=ST

NODE=M149M;LINKAGE=BG

NODE=M149M;LINKAGE=B

NODE=M149M;LINKAGE=BE

NODE=M149M;LINKAGE=CC

 $a_0(1450)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
265 ±13 OUR AVERAGE				
265 ±15		ABELE 98	CBAR	0.0 $\bar{p}p \rightarrow K_L^0 K^\pm \pi^\mp$
265 ±30		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. • • •				
112.4 ± 1.4 ± 3.4		² ALBRECHT 20	RVUE	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
282 ±12 ±13 190k		³ AAIJ 16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
230 ±36		⁴ ANISOVICH 09	RVUE	0.0 $\bar{p}p, \pi N$
65.0 ⁺ _{-5.4} ^{2.1+99.1} _{-32.6}		⁵ UEHARA 09A	BELL	$\gamma\gamma \rightarrow \pi^0 \eta$
196 ±10 ±10		⁶ BUGG 08A	RVUE	$\bar{p}p$
267 ±11 80k		⁷ UMAN 06	E835	5.2 $\bar{p}p \rightarrow \eta \eta \pi^0$
110 ±14 35k		⁴ BAKER 03	SPEC	$\bar{p}p \rightarrow \omega \pi^+ \pi^- \pi^0$
92 ±16		⁸ BARGIOTTI 03	OBLX	$\bar{p}p$
81 ±21		⁹ AMSLER 02	CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
292 ±40		⁹ ANISOVICH 98B	RVUE	Compilation
80 ± 5		¹⁰ BERTIN 98B	OBLX	0.0 $\bar{p}p \rightarrow K^\pm K_S^0 \pi^\mp$
270 ±40		AMSLER 94D	CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$
230 ±30		ETKIN 82C	MPS	23 $\pi^- p \rightarrow n 2 K_S^0$
~ 250		MARTIN 78	SPEC	10 $K^\pm p \rightarrow K_S^0 \pi p$
79 ±10		¹¹ CASON 76		

NODE=M149W

NODE=M149W

- ¹ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.
² T-matrix pole, 2 poles, 2 channels ($\pi\eta$, $K\bar{K}$).
³ Using a model with Gaussian constraints to the PDG averaged values.
⁴ From the pole position.
⁵ May be a different state.
⁶ Using data from AMSLER 94D, ABELE 98, and BAKER 03. Supersedes BUGG 94.
⁷ Statistical error only.
⁸ Coupled channel analysis of $\pi^+\pi^-\pi^0$, $K^+K^-\pi^0$, and $K^\pm K_S^0\pi^\mp$.
⁹ T-matrix pole.
¹⁰ Not confirmed by BUGG 08A.
¹¹ Isospin 0 not excluded.

NODE=M149W;LINKAGE=AB
 NODE=M149W;LINKAGE=C
 NODE=M149W;LINKAGE=A
 NODE=M149W;LINKAGE=PP
 NODE=M149W;LINKAGE=UE
 NODE=M149W;LINKAGE=BU
 NODE=M149W;LINKAGE=ST
 NODE=M149W;LINKAGE=BG
 NODE=M149W;LINKAGE=B
 NODE=M149W;LINKAGE=BE
 NODE=M149W;LINKAGE=CC

$a_0(1450)$ DECAY MODES

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

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$a_0(1450)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\pi\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_1\Gamma_6/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$432 \pm 6^{+1073}_{-256}$	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

$\Gamma(\pi\eta'(958))/\Gamma(\pi\eta)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
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.	

NODE=M149220

NODE=M149R1
 NODE=M149R1

NODE=M149R1;LINKAGE=A

$\Gamma(K\bar{K})/\Gamma(\pi\eta)$	Γ_3/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
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. • • •	
$1.887 \pm 0.041 \pm 0.97$	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=M149R2
 NODE=M149R2

NODE=M149R2;LINKAGE=A
 NODE=M149R2;LINKAGE=B

$\Gamma(\omega\pi\pi)/\Gamma(\pi\eta)$	Γ_4/Γ_1
VALUE	DOCUMENT ID TECN COMMENT
10.7 ± 2.3	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.	

NODE=M149R3
 NODE=M149R3

NODE=M149R;LINKAGE=PP

$\Gamma(a_0(980)\pi\pi)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	BUGG 08A RVUE $\bar{p}p$

NODE=M149R01
 NODE=M149R01

$\Gamma(a_0(980)\pi\pi)/\Gamma(\pi\eta)$	Γ_5/Γ_1
VALUE	DOCUMENT ID TECN CHG COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
≤ 4.3	ANISOVICH 01 RVUE 0 $\bar{p}p \rightarrow \eta 2\pi^+ 2\pi^-$

NODE=M149R02
 NODE=M149R02

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ UEHARA	09A BELL	$\gamma\gamma \rightarrow \pi^0 \eta$

¹ May be a different state.

NODE=M149R03
 NODE=M149R03

NODE=M149R03;LINKAGE=UE

NODE=M149

 $\rho(1450)$ 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	
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>	
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.) IGJPC
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)

REFID=60439
 REFID=57273
 REFID=52719
 REFID=53002
 REFID=52578
 REFID=51063
 REFID=49414
 REFID=49217
 REFID=48580
 REFID=48308
 REFID=45863
 REFID=46331

REFID=46351
 REFID=45531
 REFID=45076
 REFID=44377
 REFID=44440
 REFID=44441
 REFID=44093
 REFID=44078
 REFID=20391
 REFID=22446
 REFID=21064

NODE=M105

 $\rho(1450)$

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

NODE=M105

THE $\rho(1450)$ AND THE $\rho(1700)$

Updated September 2019 by S. Eidelman (Novosibirsk), C. Hanhart (Juelich) and G. Venanzoni (Pisa).

In our 1988 edition, we replaced the $\rho(1600)$ entry with two new ones, the $\rho(1450)$ and the $\rho(1700)$, because there was emerging evidence that the 1600-MeV region actually contains two ρ -like resonances. Erkal [1] had pointed out this possibility with a theoretical analysis on the consistency of 2π and 4π electromagnetic form factors and the $\pi\pi$ scattering length. Donnachie [2], with a full analysis of data on the 2π and 4π final states in e^+e^- annihilation and photoproduction reactions, had also argued that in order to obtain a consistent picture, two resonances were necessary. The existence of $\rho(1450)$ was supported by the analysis of $\eta\rho^0$ mass spectra obtained in photoproduction and e^+e^- annihilation [3], as well as that of $e^+e^- \rightarrow \omega\pi$ [4].

The analysis of [2] was further extended by [5,6] to include new data on 4π -systems produced in e^+e^- annihilation, and in τ -decays (τ decays to 4π , and e^+e^- annihilation to 4π can be related by the Conserved Vector Current assumption). These systems were successfully analyzed using interfering contributions from two ρ -like states, and from the tail of the $\rho(770)$ decaying into two-body states. While specific conclusions on

$\rho(1450) \rightarrow 4\pi$ were obtained, little could be said about the $\rho(1700)$.

Independent evidence for two 1^- states is provided by [7] in 4π electroproduction at $\langle Q^2 \rangle = 1$ (GeV/c)², and by [8] in a high-statistics sample of the $\eta\pi\pi$ system in π^-p charge exchange.

This scenario with two overlapping resonances is supported by other data. Bisello [9] measured the pion form factor in the interval 1.35–2.4 GeV, and observed a deep minimum around 1.6 GeV. The best fit was obtained with the hypothesis of ρ -like resonances at 1420 and 1770 MeV, with widths of about 250 MeV. Antonelli [10] found that the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section is better fitted with two fully interfering Breit-Wigners, with parameters in fair agreement with those of [2] and [9]. These results can be considered as a confirmation of the $\rho(1450)$.

Decisive evidence for the $\pi\pi$ decay mode of both $\rho(1450)$ and $\rho(1700)$ comes from $\bar{p}p$ annihilation at rest [11]. It has been shown that these resonances also possess a $K\bar{K}$ decay mode [12–14]. High-statistics studies of the decays $\tau \rightarrow \pi\pi\nu_\tau$ [15,16], and $\tau \rightarrow 4\pi\nu_\tau$ [17] also require the $\rho(1450)$, but are not sensitive to the $\rho(1700)$, because it is too close to the τ mass. A recent very-high-statistics study of the $\tau \rightarrow \pi\pi\nu_\tau$ decay performed at Belle [18] reports the first observation of both $\rho(1450)$ and $\rho(1700)$ in τ decays. A clear picture of the two $\pi^+\pi^-$ resonances interfering with the $\rho(770)$ in e^+e^- annihilation was also reported by BaBar using the ISR method [19].

The structure of these ρ states is not yet completely clear. Barnes [20] and Close [21] claim that $\rho(1450)$ has a mass consistent with radial $2S$, but its decays show characteristics of hybrids, and suggest that this state may be a $2S$ -hybrid mixture. Donnachie [22] argues that hybrid states could have a 4π decay mode dominated by the $a_1\pi$. Such behavior has been observed by [23] in $e^+e^- \rightarrow 4\pi$ in the energy range 1.05–1.38 GeV, and by [17] in $\tau \rightarrow 4\pi$ decays. CLEO [24] and Belle [25] observe the $\rho(1450) \rightarrow \omega\pi$ decay mode in B -meson decays, however, do not find $\rho(1700) \rightarrow \omega\pi^0$. A similar conclusion is made by [26,27], who studied the process $e^+e^- \rightarrow \omega\pi^0$ and do not observe a statistically significant signal of the $\rho(1700)$. Various decay modes of the $\rho(1450)$ and $\rho(1700)$ are observed in $\bar{p}n$ and $\bar{p}p$ annihilation [28,29], but no definite conclusions can be drawn. More data should be collected to clarify the nature of the ρ states, particularly in the energy range above 1.6 GeV.

We now list under a separate entry the $\rho(1570)$, the $\phi\pi$ state with $J^{PC} = 1^{--}$ earlier observed by [30] (referred to as $C(1480)$) and recently confirmed by [31]. While [32] shows that it may be a threshold effect, [5] and [33] suggest two independent vector states with this decay mode. The $C(1480)$ has not been seen in the $\bar{p}p$ [34] and e^+e^- [35,36] experiments. However, the sensitivity of the two latter is an order of magnitude lower than that of [31]. Note that [31] can not exclude that their observation is due to an OZI-suppressed decay mode of the $\rho(1700)$.

Several observations on the $\omega\pi$ system in the 1200-MeV region [37–43] may be interpreted in terms of either $J^P = 1^-$ $\rho(770) \rightarrow \omega\pi$ production [44], or $J^P = 1^+$ $b_1(1235)$ production [42,43]. We argue that no special entry for a $\rho(1250)$ is needed. The LASS amplitude analysis [45] showing evidence for $\rho(1270)$ is preliminary and needs confirmation. For completeness, the relevant observations are listed under the $\rho(1450)$.

Recently [46] reported a very broad 1^{--} resonance-like K^+K^- state in $J/\psi \rightarrow K^+K^-\pi^0$ decays. Its pole position corresponds to mass of 1576 MeV and width of 818 MeV. [47–49] suggest its exotic structure (molecular or multiquark), while [50] and [51] explain it by the interference between the $\rho(1450)$ and $\rho(1700)$. The latter statement is qualitatively supported by BaBar [52] and SND [53]. We quote [46] as $X(1575)$ in the section “Further States.”

Evidence for ρ -like mesons decaying into 6π states was first noted by [54] in the analysis of 6π mass spectra from e^+e^- annihilation [55,56] and diffractive photoproduction [57]. Clegg [54] argued that two states at about 2.1 and 1.8 GeV exist: while the former is a candidate for the $\rho(2150)$, the latter could be a manifestation of the $\rho(1700)$ distorted by threshold effects. BaBar reported observations of the new decay modes of the $\rho(2150)$ in the channels $\eta'(958)\pi^+\pi^-$ and $f_1(1285)\pi^+\pi^-$ [58]. The relativistic quark model [59] predicts the 2^3D_1 state with $J^{PC} = 1^{--}$ at 2.15 GeV which can be identified with the $\rho(2150)$.

We no longer list under a separate particle $\rho(1900)$ various observations of irregular behavior of the cross sections near the $N\bar{N}$ threshold. Dips of various width around 1.9 GeV were reported by the E687 Collaboration (a narrow one in the $3\pi^+3\pi^-$ diffractive photoproduction [60,61]), by the FENICE experiment (a narrow structure in the R value [62])

, by BaBar in ISR (a narrow structure in $e^+e^- \rightarrow \phi\pi$ final state [63], but much broader in $e^+e^- \rightarrow 3\pi^+3\pi^-$ and $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)$ [64]) , by CMD-3 (also a rather broad dip in $e^+e^- \rightarrow 3\pi^+3\pi^-$ [65]) . A dedicated scan of the $N\bar{N}$ -threshold region by CMD-3 confirms this effect in the $e^+e^- \rightarrow 3\pi^+3\pi^-$ and $e^+e^- \rightarrow K^+K^-\pi^+\pi^-$ final states, but does not see it in the cross section of $e^+e^- \rightarrow 2\pi^+2\pi^-$ [66]. Most probably, these structures emerge as a threshold effect due to the opening of the $N\bar{N}$ channel [67,68,69].

References

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-

$\rho(1450)$ MASS **$\rho(1450)$ 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=M105205

 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 $\bar{p}n \rightarrow 2\pi^-2\pi^+\pi^+$
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 ABRAMOWICZ12	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	$0.05-0.405 \bar{n}p \rightarrow$ $2\pi^+\pi^-\pi^0$
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 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=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 DUBNICKA 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

NODE=M105210

 $\rho(1450)$ 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.

NODE=M105W0
NODE=M105W0

→ UNCHECKED ←

• • • 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=M105W0;LINKAGE=A

 $\eta\rho^0$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M105W1
NODE=M105W1

• • • 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;LINKAGE=B

NODE=M105W1;LINKAGE=A

NODE=M105W;LINKAGE=SW

NODE=M105W1;LINKAGE=KL

 $\omega\pi$ MODE

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M105W3
NODE=M105W3

• • • 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⁺_– ³¹⁺⁶⁹_{52–7} 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⁺_– ⁴⁶₄₅ 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.

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

NODE=M105W66
NODE=M105W66

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

325±100 ABELE 01B CBAR 0.0 $\bar{p}n \rightarrow 2\pi^- 2\pi^0\pi^+$

$\pi\pi$ 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 ABRAMOWICZ	12	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 SCHAEEL	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 $0.05-0.405 \bar{n}p \rightarrow$ $\pi^+\pi^+\pi^-$
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 SCHAEEL 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.

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
$\Gamma_{16} \quad \pi^0\gamma$	
$\Gamma_{17} \quad \eta\gamma$	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
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;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;LINKAGE=B

NODE=M105G4;LINKAGE=A

NODE=M105G4;LINKAGE=KL

 $\Gamma(\eta\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_{10}/\Gamma$

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

$$\Gamma(K\bar{K}^*(892)+c.c.) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{10}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
127 ± 15 ± 6	AUBERT	08S BABR	10.6 e ⁺ e ⁻ → K $\bar{K}^*(892)\gamma$

NODE=M105G8
NODE=M105G8

$$\rho(1450) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M105230

$$\Gamma(\omega\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma \times \Gamma_{10}/\Gamma$$

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 ⁻ → $\pi^0\pi^0\gamma$
5.3 ± 0.4	7815	² ACHASOV	13 SND	1.05–2.00 e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R05
NODE=M105R05

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

$$\Gamma(\eta\rho)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma \times \Gamma_{10}/\Gamma$$

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 ⁻ → $\eta\pi^+\pi^-$
4.3 ^{+1.1} _{-0.9} ± 0.2	4.9k	² AULCHENKO	15 SND	1.22–2.00 e ⁺ e ⁻ → $\eta\pi^+\pi^-$

NODE=M105R00
NODE=M105R00

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

$$\Gamma(f_0(500)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT
<4.0	90	ACHASOV	11 SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R01
NODE=M105R01

$$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{16}/\Gamma \times \Gamma_{10}/\Gamma$$

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 ⁻ → $\pi^0\gamma$

NODE=M105R17
NODE=M105R17

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

$$\Gamma(f_0(980)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT
<2.6	90	ACHASOV	11 SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R02
NODE=M105R02

$$\Gamma(f_0(1370)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT
<3.5	90	ACHASOV	11 SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R03
NODE=M105R03

$$\Gamma(f_2(1270)\gamma)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}/\Gamma \times \Gamma_{10}/\Gamma$$

VALUE (units 10 ⁻⁹)	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹ ACHASOV	11 SND	e ⁺ e ⁻ → $\pi^0\pi^0\gamma$

NODE=M105R04
NODE=M105R04

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 **$\Gamma(\pi\pi)/\Gamma(4\pi)$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.37±0.10	^{1,2} ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.
² Using ABELE 97.

 Γ_1/Γ_3

NODE=M105225

NODE=M105R15
NODE=M105R15 **$\Gamma(K^+K^-)/\Gamma(\pi^+\pi^-)$**

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.

 Γ_{14}/Γ_2 NODE=M105R;LINKAGE=BL
NODE=M105R;LINKAGE=LKNODE=M105R08
NODE=M105R08

NODE=M105R08;LINKAGE=A

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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.

 Γ_4/Γ NODE=M105R5
NODE=M105R5

NODE=M105R5;LINKAGE=A

 $\Gamma(\pi\pi)/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN
~ 0.32	CLEGG	94

 $\Gamma(\omega\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN
<0.14	CLEGG	88

 Γ_1/Γ_4 NODE=M105R6
NODE=M105R6 **Γ_4/Γ_3** NODE=M105R3
NODE=M105R3 **$\Gamma(a_1(1260)\pi)/\Gamma(4\pi)$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.27±0.08	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

 Γ_5/Γ_3 NODE=M105R10
NODE=M105R10

NODE=M105R10;LINKAGE=BL

 $\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.08±0.04	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

 Γ_6/Γ_3 NODE=M105R11
NODE=M105R11

NODE=M105R11;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.37±0.13	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

 Γ_7/Γ_3 NODE=M105R12
NODE=M105R12

NODE=M105R12;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.11±0.05	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

 Γ_8/Γ_3 NODE=M105R13
NODE=M105R13

NODE=M105R13;LINKAGE=BL

 $\Gamma(\rho(\pi\pi)_{\text{S-wave}})/\Gamma(4\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.17±0.09	¹ ABELE	01B	CBAR 0.0 $\bar{p}n \rightarrow 5\pi$

¹ $\omega\pi$ not included.

 Γ_9/Γ_3 NODE=M105R14
NODE=M105R14

NODE=M105R14;LINKAGE=BL

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

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

¹From 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

 $\Gamma(\eta\rho)/\Gamma(\omega\pi)$

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 $e^+e^- \rightarrow \eta\pi^+\pi^-$

~ 0.24	³ DONNACHIE	91	RVUE

>2	FUKUI	91	SPEC 8.95 $\pi^-p \rightarrow \omega\pi^0n$

¹From 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.

²Reports the inverse of the quoted value as 12.3 ± 3.1 .

³Using 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

 $\Gamma(\pi\pi)/\Gamma(\eta\rho)$

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 $e^+e^- \rightarrow \eta\pi^+\pi^-$

¹From 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=M105R07
NODE=M105R07

NODE=M105R07;LINKAGE=A

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

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

not seen	AMELIN	00	VES 37 $\pi^-p \rightarrow \eta\pi^+\pi^-n$

NODE=M105R9
NODE=M105R9

 $\Gamma(K\bar{K})/\Gamma(\omega\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT

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

<0.08	¹ DONNACHIE	91	RVUE

¹Using data from BISELLO 91B, DOLINSKY 86 and ALBRECHT 87L.

NODE=M105R8
NODE=M105R8

NODE=M105R8;LINKAGE=A

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$

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

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

seen	35	¹ ACHASOV	14	SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$

¹From 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

GRIBANOV	20	JHEP 2001 112	S.S. Gribanov <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.)
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	14	PR D90 032002	M.N. Achasov <i>et al.</i>	(SND Collab.)
PDG	14	CP C38 070001	K. Olive <i>et al.</i>	(PDG 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.

NODE=M105

REFID=60620
REFID=58785
REFID=58900
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REFID=55912
REFID=55687
REFID=55584
REFID=54274
REFID=54275

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.)	REFID=50330
ALOISIO	05	PL B606 12	A. Aloisio <i>et al.</i>	(KLOE Collab.)	REFID=51112
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
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
AKHMETSHIN	01B	PL B509 217	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=48167
ALEXANDER	01B	PR D64 092001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=48391
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
ANDERSON	00A	PR D61 112002	S. Anderson <i>et al.</i>	(CLEO Collab.)	REFID=47468
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99C	PL B450 275	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=46916
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
BERTIN	98	PR D57 55	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45782
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BARATE	97M	ZPHY C76 15	R. Barate <i>et al.</i>	(ALEPH Collab.)	REFID=45622
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
BERTIN	97D	PL B414 220	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45763
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
BISELLO	91B	NPBPS B21 111	D. Bisello	(DM2 Collab.)	REFID=41752
DOLINSKY	91	PRPL 202 99	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=41369
DONNACHIE	91	ZPHY C51 689	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=41632
FUKUI	91	PL B257 241	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=41581
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
ARMSTRONG	89E	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)	REFID=41011
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
CLEGG	88	ZPHY C40 313	A.B. Clegg, A. Donnachie	(MCHS, LANC)	REFID=40922
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
ALBRECHT	87L	PL B185 223	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40418
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
DOLINSKY	86	PL B174 453	S.I. Dolinsky <i>et al.</i>	(NOVO)	REFID=20246
BARKOV	85	NP B256 365	L.M. Barkov <i>et al.</i>	(NOVO)	REFID=20134
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
		Translated from ZETFP 37 613.			
ASTON	80C	PL 92B 211	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=20652
BARBER	80C	ZPHY C4 169	D.P. Barber <i>et al.</i>	(DARE, LANC, SHEF)	REFID=20653
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

$\eta(1475)$

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

See the $\eta(1405)$ and the related review on "Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region."

NODE=M175

NODE=M175

NODE=M175M5

NODE=M175M5

 $\eta(1475)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1475 ± 4 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
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 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 $^{+14}_{-8} + \frac{3}{-16}$	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		¹ ABLIKIM	18i BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
1565 ± 8 $^{+0}_{-63}$		² ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
1421 ± 14		AUGUSTIN	92 DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

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 $\eta(1405)$.

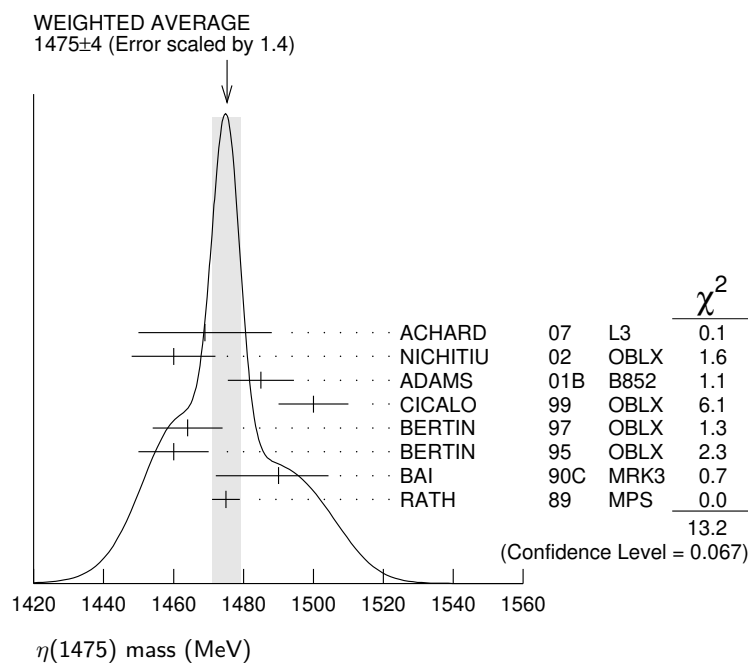
OCCUR=2

OCCUR=2

OCCUR=2

NODE=M175M5;LINKAGE=B

NODE=M175M5;LINKAGE=A

 **$\eta(1475)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
90 ± 9 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.		
67 ± 18 ± 7	74	ACHARD	07 L3	183-209 $e^+e^- \rightarrow e^+e^- K_S^0 K^\pm \pi^\mp$
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 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 $^{+37}_{-21} + \frac{13}{-24}$		BAI	90C MRK3	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
51 ± 13		RATH	89 MPS	21.4 $\pi^- p \rightarrow n K_S^0 K_S^0 \pi^0$

NODE=M175W5

NODE=M175W5

OCCUR=2

OCCUR=2

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

$118 \pm 22 \pm 17$	¹ ABLIKIM	18I	BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
45^{+14+21}_{-13-28}	² ABLIKIM	15T	BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$
63 ± 18	AUGUSTIN	92	DM2	$J/\psi \rightarrow \gamma K \bar{K} \pi$

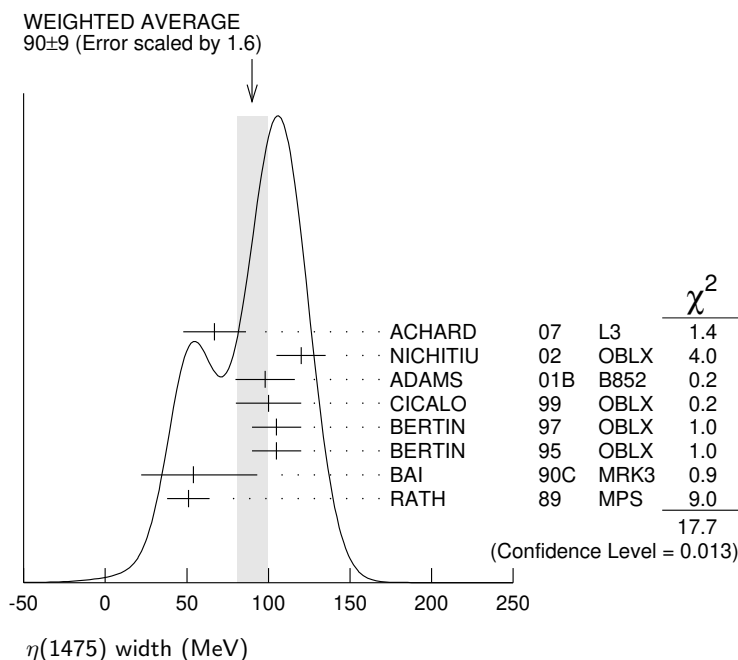
¹ From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

² Could also be the $\eta(1405)$.

OCCUR=2

NODE=M175W5;LINKAGE=B

NODE=M175W5;LINKAGE=A



$\eta(1475)$ 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
$0.23 \pm 0.05 \pm 0.05$	74
DOCUMENT ID	TECN
1 ACHARD	07 L3
COMMENT	
183-209 $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$	

NODE=M175220

NODE=M175G2
 NODE=M175G2

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

< 0.089	90	^{2,3} AHOHE	05	CLE2	$10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

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
0.50 ± 0.10	67 HBC
COMMENT	
$0.0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$	

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

0.50 ± 0.10	¹ BAILLON	67	HBC	$0.0 \bar{p} p \rightarrow K \bar{K} \pi \pi \pi$

¹ Data could also refer to $\eta(1405)$.

NODE=M175225

NODE=M175R1
 NODE=M175R1

NODE=M175R;LINKAGE=BL

$$\frac{\Gamma(K\bar{K}^*(892) + \text{c.c.})}{[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(a_0(980)\pi)]} \quad \Gamma_2/(\Gamma_2 + \Gamma_3)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.25	90	EDWARDS	82E	CBAL	$J/\psi \rightarrow K^+ K^- \pi^0 \gamma$

$$\frac{\Gamma(\gamma\gamma)}{\Gamma(K\bar{K}\pi)} \quad \Gamma_4/\Gamma_1$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<1.27 \times 10^{-3}$	90	¹ ABLIKIM	180	BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$

¹ Using results from BAI 00D.

$$\frac{\Gamma(\gamma\phi(1020))}{\Gamma_{\text{total}}} \quad \Gamma_6/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

possibly seen	¹ ABLIKIM	18I	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 $\eta(1405)$.

$\eta(1475)$ 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	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)

$f_0(1500)$

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

See the reviews on "Scalar Mesons below 2 GeV" and on "Non- $q\bar{q}$ Mesons".

$f_0(1500)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1506 ± 6 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

1515 ± 12	¹	BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta p_s$
1511 ± 9	^{1,2}	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
1510 ± 8	¹	BARBERIS	00E	450 $pp \rightarrow p_f \eta \eta p_s$
1522 ± 25	¹	BERTIN	98	OBLX 0.05–0.405 $\bar{n}p \rightarrow$

1449 ± 20	¹	BERTIN	97C	OBLX 0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
1500 ± 10	³	AMSLER	95D	CBAR 0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \eta \eta$, $\pi^0 \pi^0 \eta$

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

1496 ± 1.2 ⁺ _{−26.4}	⁴	ALBRECHT	20	RVUE 0.9 $\bar{p}p \rightarrow \pi^0 \pi^0 \eta$, $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$
1465 ± 18	⁵	ROPERTZ	18	RVUE $\bar{B}_s^0 \rightarrow$ $J/\psi(\pi^+ \pi^- / K^+ K^-)$
1447 ± 16 ± 13	^{6,7}	DOBBS	15	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
1442 ± 9 ± 4	^{6,7}	DOBBS	15	$\psi(2S) \rightarrow \gamma \pi^+ \pi^-$
1460.9 ± 2.9	⁸	AAIJ	14BR LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$

NODE=M175R6
NODE=M175R6

NODE=M175R01
NODE=M175R01

NODE=M175R01;LINKAGE=A

NODE=M175R00
NODE=M175R00

NODE=M175R00;LINKAGE=A

NODE=M175

REFID=58893
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REFID=20407

NODE=M152

NODE=M152

NODE=M152M

NODE=M152M

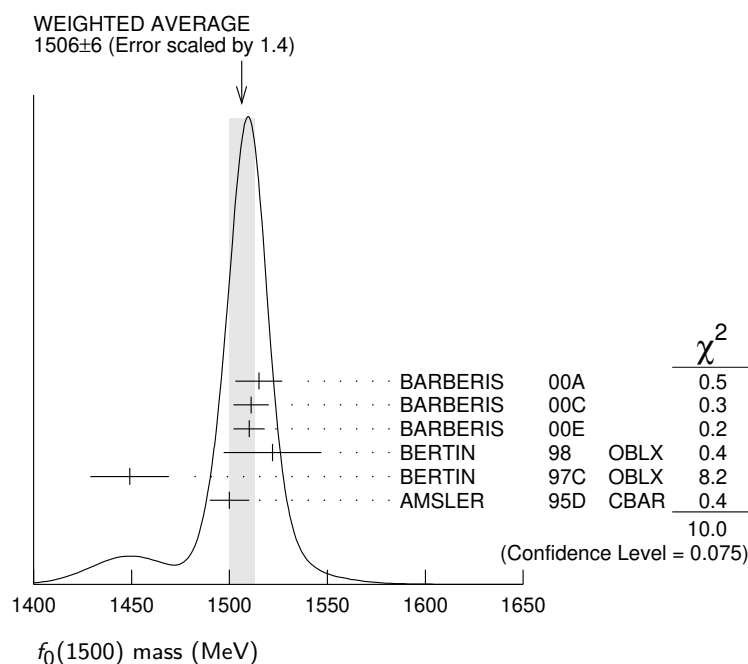
OCCUR=2

- 7 From a fit to a Breit-Wigner line shape with fixed $\Gamma = 109$ MeV.
 8 Solution 1, statistical error only.
 9 From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
 10 Reanalysis of AITALA 01A data. This state could also be $f_0(1370)$.
 11 Breit-Wigner mass. May also be the $f_0(1370)$.
 12 Breit-Wigner mass.
 13 Statistical error only.
 14 Breit-Wigner, solution 1, PWA ambiguous.
 15 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.
 16 Supersedes BARBERIS 99 and BARBERIS 99B.
 17 T-matrix pole on sheet $--+$.
 18 T-matrix pole, supersedes ANISOVICH 94.
 19 T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
 20 Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
 21 From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$.
 22 Reanalysis of ANISOVICH 94 data.
 23 From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152M;LINKAGE=G
 NODE=M152M;LINKAGE=I
 NODE=M152M;LINKAGE=C

NODE=M152M;LINKAGE=KL
 NODE=M152M;LINKAGE=UE
 NODE=M152M;LINKAGE=E
 NODE=M152M;LINKAGE=ST
 NODE=M152M;LINKAGE=GA
 NODE=M152M;LINKAGE=KM

NODE=M152M;LINKAGE=BD
 NODE=M152M;LINKAGE=TK
 NODE=M152M;LINKAGE=D
 NODE=M152M;LINKAGE=D1
 NODE=M152M;LINKAGE=B
 NODE=M152M;LINKAGE=A
 NODE=M152M;LINKAGE=C1
 NODE=M152M;LINKAGE=AZ



$f_0(1500)$ WIDTH

NODE=M152W

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
112 $\pm$ 9	OUR AVERAGE			
110 $\pm$ 24		¹ BARBERIS	00A	450 $p p \rightarrow p_f \eta \eta p_s$
102 $\pm$ 18		^{1,2} BARBERIS	00C	450 $p p \rightarrow p_f 4\pi p_s$
110 $\pm$ 16		¹ BARBERIS	00E	450 $p p \rightarrow p_f \eta \eta p_s$
108 $\pm$ 33		¹ BERTIN	98 OBLX	0.05–0.405 $\bar{n} p \rightarrow \pi^+ \pi^+ \pi^-$
114 $\pm$ 30		¹ BERTIN	97C OBLX	0.0 $\bar{p} p \rightarrow \pi^+ \pi^- \pi^0$
154 $\pm$ 30		³ AMSLER	95D CBAR	0.0 $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
80.8 $\pm$ 0.6 $^{+20.0}_{-5.0}$		⁴ ALBRECHT	20 RVUE	0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
100 $\pm$ 18		⁵ ROPERTZ	18 RVUE	$\bar{B}_s^0 \rightarrow J/\psi (\pi^+ \pi^- / K^+ K^-)$
124 $\pm$ 7		⁶ AAIJ	14BR LHCB	$\bar{B}_s^0 \rightarrow J/\psi \pi^+ \pi^-$

NODE=M152W

136	$+41$ -26	$+28$ -100	5.5k	7	ABLIKIM	13N	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$	
114	± 10			1	ANISOVICH	09	RVUE	$0.0 \bar{p}p, \pi N$	
90	$+2$ -1	$+50$ -22		8	UEHARA	08A	BELL	$10.6 \frac{e^+e^- \rightarrow e^+e^- \pi^0 \pi^0}{e^+e^- \pi^0 \pi^0}$	
108	$+14$ -11	± 25		9	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	06O	BABR	$B^+ \rightarrow K^+K^+K^-$	
108	± 9		80k	9,10	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			9	BINON	05	GAMS	$33 \pi^- p \rightarrow \eta\eta n$	
136	± 23		1400	11	GARMASH	05	BELL	$B^+ \rightarrow K^+K^+K^-$	
102	± 10			12	ANISOVICH	03	RVUE		
140	± 40			9	ABELE	01	CBAR	$0.0 \bar{p}d \rightarrow \pi^- 4\pi^0 p$	
104	± 25			9	BARBERIS	99	OMEG	$450 pp \rightarrow p_S p_f K^+ K^-$	
131	± 15			9	BARBERIS	99B	OMEG	$450 pp \rightarrow p_S p_f \pi^+ \pi^-$	
98	± 18	± 16		13	BARBERIS	99D	OMEG	$450 pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
160	± 50			9	BELLAZZINI	99	GAM4	$450 pp \rightarrow pp\pi^0\pi^0$	
100	± 33			9	FRENCH	99		$300 pp \rightarrow p_f(K^+K^-)p_S$	
108	± 46			14	KAMINSKI	99	RVUE	$\pi\pi \rightarrow \pi\pi, K\bar{K}, \sigma\sigma$	
280	± 100			9	ALDE	98	GAM4	$100 \pi^- p \rightarrow \pi^0\pi^0 n$	
130	± 20			1	ANISOVICH	98B	RVUE	Compilation	
120	± 35			1	BARBERIS	97B	OMEG	$450 pp \rightarrow pp2(\pi^+\pi^-)$	
~ 100					FRABETTI	97D	E687	$D_S^\pm \rightarrow \pi^\mp \pi^\pm \pi^\pm$	
~ 169					ABELE	96	CBAR	$0.0 \bar{p}p \rightarrow 5\pi^0$	
105	± 15				ABELE	96B	CBAR	$0.0 \bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$	
100	± 30		120	9	AMELIN	96B	VES	$37 \pi^- A \rightarrow \eta\eta\pi^- A$	
132	± 15				BUGG	96	RVUE		
120	± 25			15	AMSLER	95B	CBAR	$0.0 \bar{p}p \rightarrow 3\pi^0$	
120	± 30			16	AMSLER	95C	CBAR	$0.0 \bar{p}p \rightarrow \eta\eta\pi^0$	OCCUR=2
65	± 10			17	ANTINORI	95	OMEG	$300,450 pp \rightarrow pp2(\pi^+\pi^-)$	
199	± 30			9	ANTINORI	95	OMEG	$300,450 pp \rightarrow pp\pi^+\pi^-$	OCCUR=2
56	± 12			9	ABATZIS	94	OMEG	$450 pp \rightarrow pp2(\pi^+\pi^-)$	
100	± 40			9	AMSLER	94E	CBAR	$0.0 \bar{p}p \rightarrow \pi^0\eta\eta'$	
148	$+20$ -25			1,18	ANISOVICH	94	CBAR	$0.0 \bar{p}p \rightarrow 3\pi^0, \pi^0\eta\eta$	
150	± 20			1,19	BUGG	94	RVUE	$\bar{p}p \rightarrow 3\pi^0, \eta\eta\pi^0, \eta\pi^0\pi^0$	
245	± 50			9	AMSLER	92	CBAR	$0.0 \bar{p}p \rightarrow \pi^0\eta\eta$	
153	± 67	± 50		9	BELADIDZE	92C	VES	$36 \pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$	
78	± 18			9	ARMSTRONG	89E	OMEG	$300 pp \rightarrow pp2(\pi^+\pi^-)$	
170	± 40			9	ALDE	88	GAM4	$300 \pi^- N \rightarrow \pi^- N 2\eta$	
150	± 20		600	9	ALDE	87	GAM4	$100 \pi^- p \rightarrow 4\pi^0 n$	
265	± 65			20	ALDE	86D	GAM4	$100 \pi^- p \rightarrow 2\eta n$	
260	± 60			9	BINON	84C	GAM2	$38 \pi^- p \rightarrow \eta\eta' n$	
210	± 40			9	BINON	83	GAM2	$38 \pi^- p \rightarrow 2\eta n$	
101	± 13			9	GRAY	83	DBC	$0.0 \bar{p}N \rightarrow 3\pi$	

¹ T-matrix pole.

² Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.

³ T-matrix pole. Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

⁴ 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 ($\eta\eta'$).

⁵ T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.

⁶ Solution I, statistical error only.

⁷ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁸ Breit-Wigner width. May also be the $f_0(1370)$.

⁹ Breit-Wigner width.

¹⁰ Statistical error only.

¹¹ Breit-Wigner, solution 1, PWA ambiguous.

NODE=M152W;LINKAGE=PP

NODE=M152W;LINKAGE=PC

NODE=M152W;LINKAGE=AB

NODE=M152W;LINKAGE=H

NODE=M152W;LINKAGE=F

NODE=M152W;LINKAGE=G

NODE=M152W;LINKAGE=C

NODE=M152W;LINKAGE=UE

NODE=M152W;LINKAGE=E

NODE=M152W;LINKAGE=ST

NODE=M152W;LINKAGE=GA

- ¹² 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.
- ¹³ Supersedes BARBERIS 99 and BARBERIS 99B.
- ¹⁴ T-matrix pole on sheet $--+$.
- ¹⁵ T-matrix pole, supersedes ANISOVICH 94.
- ¹⁶ T-matrix pole, supersedes ANISOVICH 94 and AMSLER 92.
- ¹⁷ Supersedes ABATZIS 94, ARMSTRONG 89E. Breit-Wigner mass.
- ¹⁸ From a simultaneous analysis of the annihilations $\bar{p} p \rightarrow 3\pi^0, \pi^0 \eta \eta$.
- ¹⁹ Reanalysis of ANISOVICH 94 data.
- ²⁰ From central value and spread of two solutions. Breit-Wigner mass.

NODE=M152W;LINKAGE=KM

NODE=M152W;LINKAGE=BD
 NODE=M152W;LINKAGE=TK
 NODE=M152W;LINKAGE=D
 NODE=M152W;LINKAGE=D1
 NODE=M152W;LINKAGE=B
 NODE=M152W;LINKAGE=A
 NODE=M152W;LINKAGE=C1
 NODE=M152W;LINKAGE=AZ

 $f_0(1500)$ DECAY MODES

	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	

NODE=M152215;NODE=M152

DESIG=8
 DESIG=9
 DESIG=3;OUR EST;→ UNCHECKED ←
 DESIG=7
 DESIG=5;OUR EST;→ UNCHECKED ←
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 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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_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	
• • • 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
 NODE=M152G1

NODE=M152G1;LINKAGE=UE

$f_0(1500)$ BRANCHING RATIOS

NODE=M152220

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ **Γ_1/Γ** NODE=M152R8
NODE=M152R8

VALUE	DOCUMENT ID	TECN

• • • 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** NODE=M152R10
NODE=M152R10

VALUE	DOCUMENT ID	TECN	COMMENT

seen	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. • • •

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** NODE=M152R6
NODE=M152R6

VALUE	DOCUMENT ID	TECN	COMMENT

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 $p\bar{p} \rightarrow p_f 4\pi p_s$

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 **$\Gamma(2(\pi\pi)S\text{-wave})/\Gamma(\pi\pi)$** **$\Gamma_7/\Gamma_1$** NODE=M152R14
NODE=M152R14

VALUE	DOCUMENT ID	TECN	COMMENT

• • • 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

 $\Gamma(2(\pi\pi)S\text{-wave})/\Gamma(4\pi)$ **Γ_7/Γ_4** NODE=M152R15
NODE=M152R15

VALUE	DOCUMENT ID	TECN	COMMENT

• • • 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** NODE=M152R16
NODE=M152R16

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.13±0.08	ABELE	01B	CBAR 0.0 $\bar{p}d \rightarrow 5\pi p$

 $\Gamma(\rho\rho)/\Gamma(2(\pi\pi)S\text{-wave})$ **Γ_8/Γ_7** NODE=M152R11
NODE=M152R11

VALUE	DOCUMENT ID	COMMENT

2.87±0.34 OUR AVERAGE Error includes scale factor of 1.1.

3.3 ±0.5	BARBERIS	00C	450 $p\bar{p} \rightarrow p_f \pi^+ \pi^- 2\pi^0 p_s$

2.6 ±0.4	BARBERIS	00C	450 $p\bar{p} \rightarrow p_f 2(\pi^+ \pi^-) p_s$

OCCUR=2

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ **Γ_9/Γ_4** NODE=M152R17
NODE=M152R17

VALUE	DOCUMENT ID	TECN	COMMENT

• • • 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** NODE=M152R18
NODE=M152R18

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 $\bar{p}d \rightarrow 5\pi p$

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ **Γ_{11}/Γ** NODE=M152R1
NODE=M152R1

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 $\pi^- p \rightarrow 2\eta n$

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ 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 $\bar{p}p \rightarrow \eta \eta \pi^0$

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=M152R13
NODE=M152R13NODE=M152R3;LINKAGE=AB
NODE=M152R;LINKAGE=CHNODE=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	DOCUMENT ID	TECN	COMMENT

0.064±0.022 OUR FIT Error includes scale factor of 1.4.**0.095±0.026** 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. • • •

0.005±0.003	¹ ANISOVICH	02D SPEC	Combined fit

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=M152R12
NODE=M152R12

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

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
NODE=M152R2NODE=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 $\bar{p}p \rightarrow \pi^0 K_L^0 K_L^0$
• • • 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 $p\bar{p} \rightarrow K^+ K^-, \pi^+ \pi^-$

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 $p\bar{p} \rightarrow p_f \eta \eta p_s$
● ● ● 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

 $\phi(1500)$ REFERENCES

NODE=M152

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel 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.)
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	Ablikim M. <i>et al.</i>	(BESIII Collab.)
ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
KLEMP	08	EPJ C55 39	E. Klempt, 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>	
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.				
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. Bitukov, G.V. Borisov	(SERP+)
Translated from YAF 55 2748.				
PROKOSHKIN	91	SPD 36 155	V.D. Prokoshkin	(GAM2 and GAM4 Collab.)
Translated from DANS 316 900.				
ARMSTRONG	88	PL B228 536	T.A. Armstrong, M. Benayoun	(ATHU, BARI, BIRM+)
ALDE	88E	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		SJNP 38 561	F.G. Binon <i>et al.</i>	(BELG, LAPP, SERP+)
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)

REFID=60439
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 REFID=20751

REFID=21370
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 REFID=20381
 REFID=20355

$f_1(1510)$

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

OMITTED FROM SUMMARY TABLE

See the minireview under $\eta(1405)$.

NODE=M084

NODE=M084

NODE=M084M

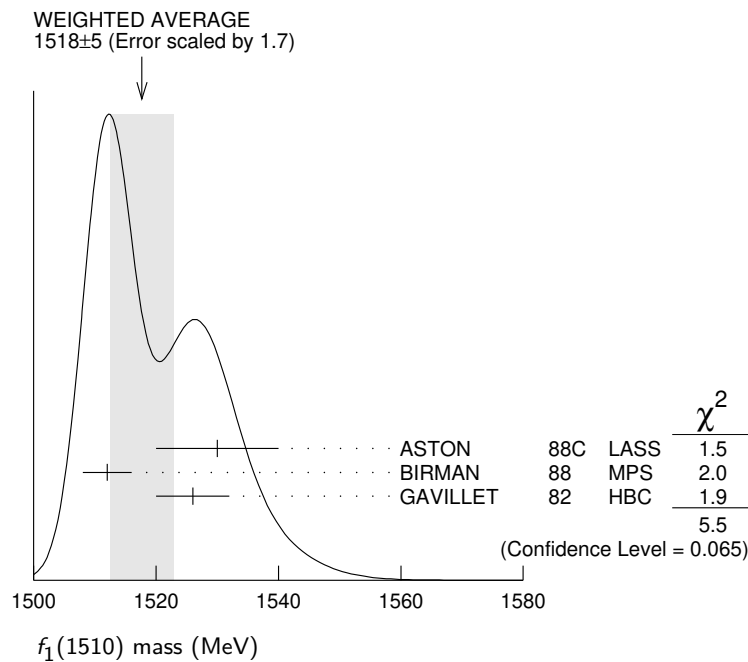
NODE=M084M

 $f_1(1510)$ MASS

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

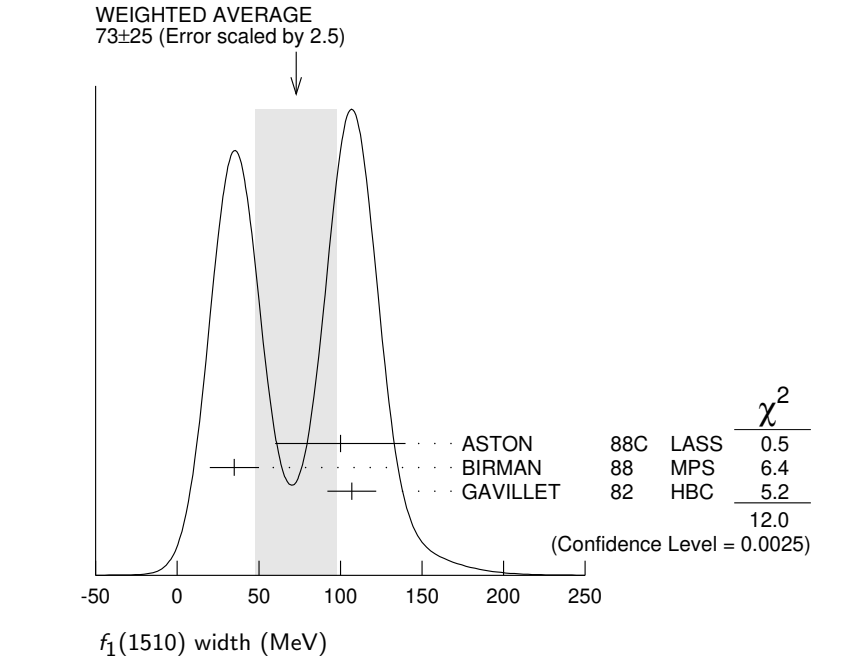
 **$f_1(1510)$ WIDTH**

NODE=M084W

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;LINKAGE=A



$f_1(1510)$ 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

$f_1(1510)$ 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

$f_1(1510)$ 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-2 γ 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
REFID=43678
REFID=40564
REFID=40282
REFID=40568
REFID=20877

$f'_2(1525)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M013

 $f'_2(1525)$ MASS

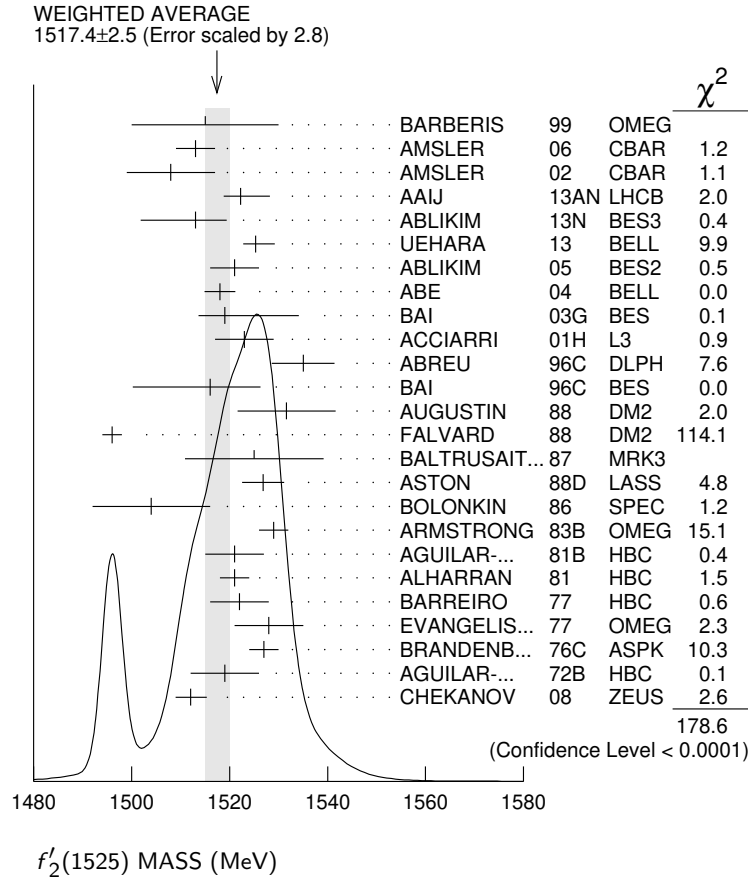
NODE=M013MX

VALUE (MeV)

DOCUMENT ID

1517.4±2.5 OUR AVERAGE Includes data from the 6 datablocks that follow this one.
Error includes scale factor of 2.8. See the ideogram below.

NODE=M013MX



PRODUCED BY PION BEAM

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT

NODE=M013M1
NODE=M013M1

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 $\pi^- p \rightarrow K_S^0 K_S^0 n$

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.

OCCUR=2

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

1518.1 ± 2.8 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 3.0. See the ideogram below.

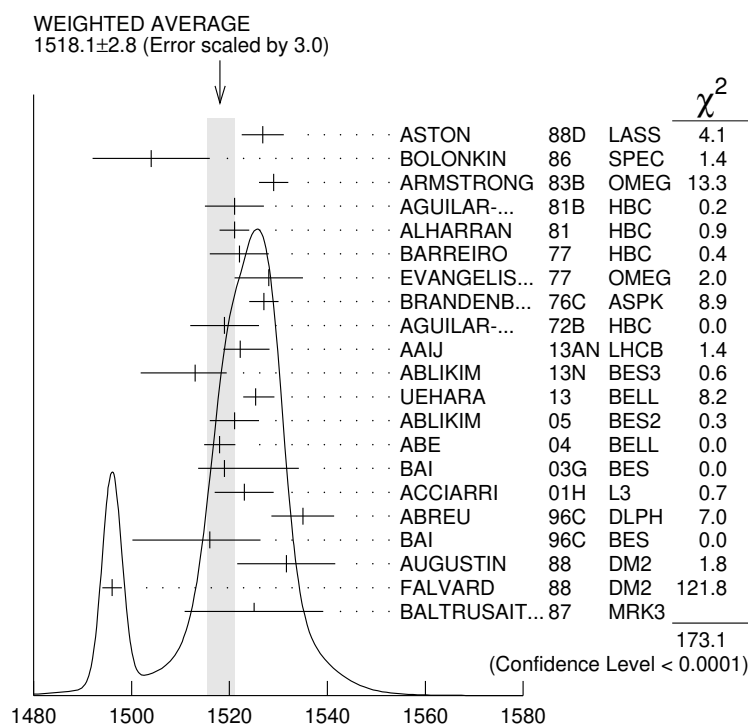
1526.8 ± 4.3		ASTON	88D	LASS	11	$K^- p \rightarrow K_S^0 K_S^0 \Lambda$
1504 ± 12		BOLONKIN	86	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 Y$
1529 ± 3		ARMSTRONG	83B	OMEG	18.5	$K^- p \rightarrow K^- K^+ \Lambda$
1521 ± 6	650	AGUILAR...	81B	HBC	4.2	$K^- p \rightarrow \Lambda K^+ K^-$
1521 ± 3	572	ALHARRAN	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	$K^- p \rightarrow K_S^0 K_S^0 y$

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 $\pm \frac{5}{4}$ OUR AVERAGE Error includes scale factor of 3.8. See the ideogram below.

1522.2 ± 2.8 $\pm \frac{5.3}{2.0}$		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
1513 ± 5 $\pm \frac{4}{10}$ 5.5k	¹	ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
1525.3 $\pm \frac{1.2}{1.4} \pm \frac{3.7}{2.1}$		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 $\pm \frac{15}{5}$		BAI	03G	BES	$J/\psi \rightarrow \gamma K \bar{K}$
1523 ± 6	331	² ACCIARRI	01H	L3	91, 183-209 $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$

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

OCCUR=2

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

1532 ± 3 ± 6	644	^{4,5} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
1557 ± 9 ± 3	113	^{4,5} DOBBS	15	$\psi(2S) \rightarrow \gamma K^+ K^-$
1526 ± 7	29	⁶ LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$
1523 ± 5	870	⁷ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
1515 ± 5		⁸ FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-$

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 Using CLEO-c data but not authored by the CLEO Collaboration.

⁵ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 73$ MeV.

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=M013M3;LINKAGE=A

NODE=M013M;LINKAGE=HA

NODE=M013M;LINKAGE=F2

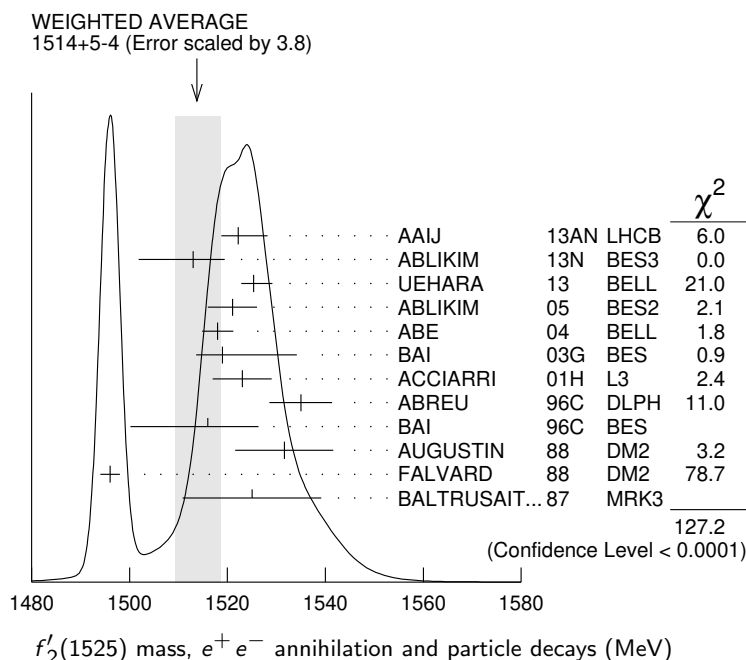
NODE=M013M3;LINKAGE=B

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	$0.0 \bar{p}p, \pi N$

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 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.

1515 ± 15	BARBERIS	99	OMEG	$450 pp \rightarrow p_s p_f K^+ K^-$

NODE=M013M4

NODE=M013M4

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

$1512 \pm 3^{+1.4}_{-0.5}$ 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

NODE=M013WX

VALUE (MeV)	DOCUMENT ID	COMMENT

86 ± 5 OUR FIT Error includes scale factor of 2.2.

$86.9^{+2.3}_{-2.1}$ PDG 18 Average of width measurements

NODE=M013WX

PRODUCED BY PION BEAM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M013W1
 NODE=M013W1

$86.9^{+2.3}_{-2.1}$ OUR AVERAGE Includes data from the 5 datablocks that follow 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. • • •

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.

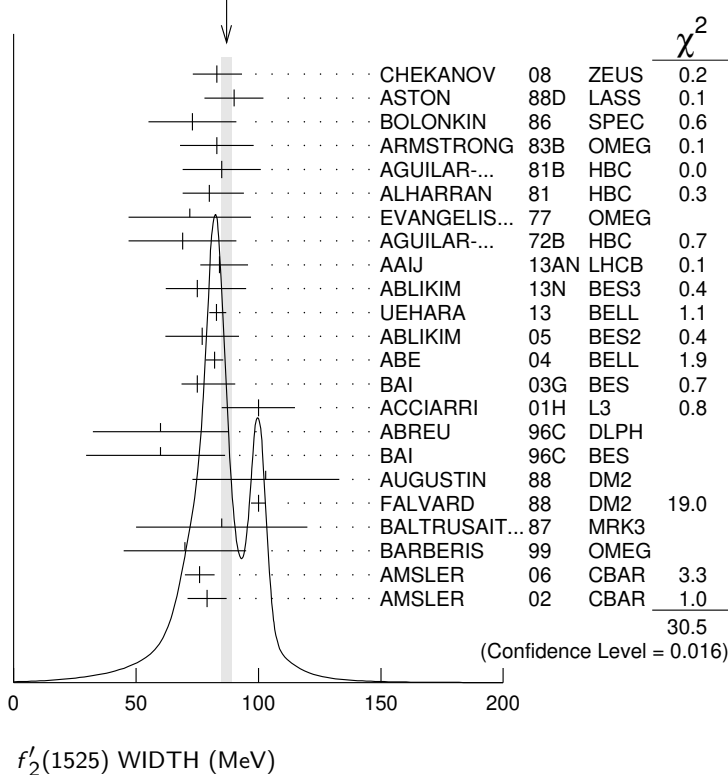
NODE=M013W;LINKAGE=L

NODE=M013W;LINKAGE=D

NODE=M013W;LINKAGE=N

NODE=M013W;LINKAGE=M

WEIGHTED AVERAGE
86.9+2.3-2.1 (Error scaled by 1.4)



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 $\pm$ 6 OUR AVERAGE

90 $\pm$ 12		ASTON	88D	LASS	11	$K^- p \rightarrow K_S^0 K_S^0 \Lambda$
73 $\pm$ 18		BOLONKIN	86	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 \gamma$
83 $\pm$ 15		ARMSTRONG	83B	OMEG	18.5	$K^- p \rightarrow K^- K^+ \Lambda$
85 $\pm$ 16	650	AGUILAR-...	81B	HBC	4.2	$K^- p \rightarrow \Lambda K^+ K^-$
80 $\pm$ 14 -11	572	ALHARRAN	81	HBC	8.25	$K^- p \rightarrow \Lambda K \bar{K}$
72 $\pm$ 25	166	EVANGELIS...	77	OMEG	10	$K^- p \rightarrow K^+ K^- (\Lambda, \Sigma)$
69 $\pm$ 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 $\pm$ 25 -16	61	BINON	07	GAMS	32.5	$K^- p \rightarrow \eta \eta (\Lambda / \Sigma^0)$
75 $\pm$ 20		¹ BARKOV	99	SPEC	40	$K^- p \rightarrow K_S^0 K_S^0 \gamma$
62 $\pm$ 19 -14	123	BARREIRO	77	HBC	4.15	$K^- p \rightarrow \Lambda K_S^0 K_S^0$
61 $\pm$ 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

89.2 $\pm$ 3.4 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.

84 $\pm$ 6 $\pm$ 10 -5		AAIJ	13AN	LHCB	$\bar{B}_s^0 \rightarrow J/\psi K^+ K^-$
75 $\pm$ 12 $\pm$ 16 -10 -8	5.5k	¹ ABLIKIM	13N	BES3	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
82.9 $\pm$ 2.1 $\pm$ 3.3 -2.2 -2.0		UEHARA	13	BELL	$\gamma \gamma \rightarrow K_S^0 K_S^0$
77 $\pm$ 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 $\pm$ 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 ±20 ±19		ABREU	96c DLPH	$Z^0 \rightarrow K^+K^- + X$
60 ±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	$J/\psi \rightarrow \gamma K^+K^-$

OCCUR=2

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

37 ±12	29	⁴ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+K^- \gamma$
104 ±10	870	⁵ SCHEGELSKY	06A RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$
62 ±10		⁶ 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 From a fit to a Breit-Wigner line shape plus a second-order polynomial function. Systematic errors not evaluated.

⁵ From analysis of L3 data at 91 and 183–209 GeV.

⁶ From an analysis ignoring interference with $f_0(1710)$.

NODE=M013W3;LINKAGE=A

NODE=M013W;LINKAGE=HA

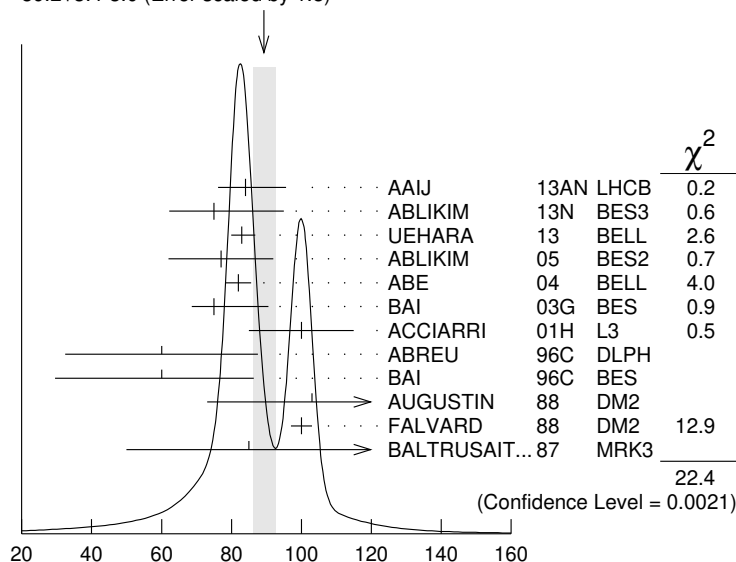
NODE=M013W;LINKAGE=F2

NODE=M013W3;LINKAGE=B

NODE=M013W3;LINKAGE=SC

NODE=M013W;LINKAGE=F1

WEIGHTED AVERAGE
89.2±3.4-3.0 (Error scaled by 1.8)



$f'_2(1525)$ width, e^+e^- annihilation and particle decays (MeV)

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;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 $pp \rightarrow p_s p_f K^+K^-$

NODE=M013W4

NODE=M013W4

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=M013W10
 NODE=M013W10

$83 \pm 9^{+5}_{-4}$ 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. • • •

50^{+34}_{-22} 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=M013W10;LINKAGE=HE

NODE=M013W10;LINKAGE=CH

 $f_2'(1525)$ DECAY MODES

NODE=M013215;NODE=M013

	Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1	$K\bar{K}$	$(87.6 \pm 2.2) \%$	1.1
Γ_2	$\eta\eta$	$(11.6 \pm 2.2) \%$	1.1
Γ_3	$\pi\pi$	$(8.3 \pm 1.6) \times 10^{-3}$	
Γ_4	$K\bar{K}^*(892) + \text{c.c.}$		
Γ_5	$\pi K\bar{K}$		
Γ_6	$\pi\pi\eta$		
Γ_7	$\pi^+\pi^+\pi^-\pi^-$		
Γ_8	$\gamma\gamma$	$(9.5 \pm 1.1) \times 10^{-7}$	1.1

DESIG=2

DESIG=4

DESIG=1

DESIG=3

DESIG=6

DESIG=5

DESIG=7

DESIG=8

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 2 partial widths, a combination of partial widths obtained from integrated cross sections, and 3 branching ratios uses 17 measurements and one constraint to determine 5 parameters. The overall fit has a $\chi^2 = 18.2$ for 13 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, 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	-100			
x_3	-6	-1		
x_8	-19	19	1	
Γ	-4	4	0	-44
	x_1	x_2	x_3	x_8

	Mode	Rate (MeV)	Scale factor
Γ_1	$K\bar{K}$	75 ± 4	1.8
Γ_2	$\eta\eta$	9.9 ± 1.9	1.1
Γ_3	$\pi\pi$	0.71 ± 0.14	1.1
Γ_8	$\gamma\gamma$	$(8.2 \pm 0.9) \times 10^{-5}$	

DESIG=2

DESIG=4

DESIG=1

DESIG=8

 $f_2'(1525)$ PARTIAL WIDTHS

NODE=M013220

$\Gamma(K\bar{K})$

Γ_1

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
75 ± 4 OUR FIT	Error includes scale factor of 1.8.		

NODE=M013W6

NODE=M013W6

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=M013PW;LINKAGE=L

$\Gamma(\eta\eta)$ Γ_2

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

9.9±1.9 OUR FIT Error includes scale factor of 1.1.

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

5.0±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

NODE=M013W7;LINKAGE=SC

NODE=M013PW7;LINKAGE=L

 $\Gamma(\pi\pi)$ Γ_3

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.71±0.14 OUR FIT Error includes scale factor of 1.1.**1.4 $\begin{smallmatrix} +1.0 \\ -0.5 \end{smallmatrix}$** 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

NODE=M013PW5;LINKAGE=L

NODE=M013W5;LINKAGE=SC

 $\Gamma(\gamma\gamma)$ Γ_8

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT

0.082±0.009 OUR 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

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 $\begin{smallmatrix} +0.166 \\ -0.162 \end{smallmatrix}$ 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 $\begin{smallmatrix} +0.067 \\ -0.008 \end{smallmatrix}$ $\begin{smallmatrix} +0.108 \\ -0.012 \end{smallmatrix}$ 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 $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$ ±0.02 BEHREND 89c CELL $e^+ e^- \rightarrow e^+ e^- K_S^0 K_S^0$ 0.10 $\begin{smallmatrix} +0.04 \\ -0.03 \end{smallmatrix}$ $\begin{smallmatrix} +0.03 \\ -0.02 \end{smallmatrix}$ 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

$f'_2(1525)$ 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. • • •

$0.059 \pm 0.003 \pm 0.026$	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 PROKOSHKIN 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;LINKAGE=A

NODE=M013R8;LINKAGE=B

 $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ **Γ_2/Γ_1**

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.132 $\pm$ 0.028 OUR FIT**0.115 $\pm$ 0.028 OUR AVERAGE**

$0.119 \pm 0.015 \pm 0.036$	61	¹ BINON	07	GAMS	$32.5 K^- p \rightarrow \eta \eta (\Lambda/\Sigma^0)$
0.11 ± 0.04		² PROKOSHKIN 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		$450 p p \rightarrow p_f \eta \eta p_s$
< 0.50		BARNES	67	HBC	$4.6, 5.0 K^- p$

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

0.83 $\pm$ 0.16 OUR FIT**0.75 $\pm$ 0.16 OUR AVERAGE**

0.7 ± 0.2		COSTA	80	OMEG	$10 \pi^- p \rightarrow K^+ K^- n$
$2.7^{+7.1}_{-1.3}$		¹ GORLICH	80	ASPK	$17, 18 \pi^- p$
0.75 ± 0.25		^{1,2} MARTIN	79	RVUE	
$3.4 \pm 1.5 \pm 1.0$		³ ALBRECHT	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		¹ PAWLICKI	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		¹ BEUSCH	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;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

0.0094 $\pm$ 0.0018 OUR FIT**0.075 $\pm$ 0.035**AUGUSTIN 87 DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M013R7

NODE=M013R7

 $[\Gamma(K\bar{K}^*(892) + \text{c.c.}) + \Gamma(\pi K\bar{K})]/\Gamma(K\bar{K})$ **$(\Gamma_4 + \Gamma_5)/\Gamma_1$**

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

NODE=M013

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)	REFID=59304
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
LEES	14H	PR D89 092002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55940
AAIJ	13AN	PR D87 072004	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=55137
ABLIKIM	13N	PR D87 092009	Ablikim M. <i>et al.</i>	(BESIII Collab.)	REFID=55387
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		REFID=52719
CHEKANOV	08	PRL 101 112003	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=52275
BINON	07	PAN 70 1713	F. Binon <i>et al.</i>	(GAMS Collab.)	REFID=52057
AMSLER	06	Translated from YAF 70 1758.	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
SCHEGELSKY	06A	PL B639 165	V.A. Schegelsky <i>et al.</i>		REFID=51185
ABLIKIM	05	EPJ A27 207	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=50450
ABE	04	PL B607 243	K. Abe <i>et al.</i>	(BELLE Collab.)	REFID=49650
CHEKANOV	04	EPJ C32 323	S. Chekanov <i>et al.</i>	(ZEUS Collab.)	REFID=49672
BAI	03G	PL B578 33	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49580
TIKHOMIROV	03	PR D68 052003	G.D. Tikhomirov <i>et al.</i>		REFID=49423
AMSLER	02	PAN 66 828	C. Amsler <i>et al.</i>		REFID=48580
ACCARI	01H	Translated from YAF 66 860.	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=48321
BARBERIS	00E	EPJ C23 29	D. Barberis <i>et al.</i>	(WA 102 Collab.)	REFID=47961
BARBERIS	99	PL B501 173	D. Barberis <i>et al.</i>	(Omega Expt.)	REFID=46921
BARKOV	99	PL B479 59	B.P. Barkov <i>et al.</i>		REFID=47379
ABREU	96C	JETPL 70 248	P. Abreu <i>et al.</i>	(DELPHI Collab.)	REFID=44671
BAI	96C	Translated from ZETFP 70 242.	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=45169
ACCARI	95J	PL B379 309	M. Acciarri <i>et al.</i>	(L3 Collab.)	REFID=44615
PROKOSHKIN	91	PRL 77 3959	Y.D. Prokoshkin	(GAM2 and GAM4 Collab.)	REFID=41719
ALBRECHT	90G	PL B363 118	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=41374
BEHREND	89C	SPD 36 155	H.J. Behrend <i>et al.</i>	(CELLO Collab.)	REFID=40915
ASTON	88D	Translated from DANS 316 900.	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)	REFID=40330
AUGUSTIN	88	ZPHY C48 183	J.E. Augustin <i>et al.</i>	(DM2 Collab.)	REFID=40574
BERGER	88	ZPHY C43 91	C. Berger <i>et al.</i>	(PLUTO Collab.)	REFID=40566
FALVARD	88	NP B301 525	A. Falvard <i>et al.</i>	(CLER, FRAS, LALO+)	REFID=40576
AUGUSTIN	87	PR D38 2706	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)	REFID=40268
BALTRUSAIT...	87	ZPHY C36 369	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=40010
AIHARA	86B	PR D35 2077	H. Aihara <i>et al.</i>	(TPC-2 γ Collab.)	REFID=20764
BOLONKIN	86	PRL 57 404	B.V. Bolonkin <i>et al.</i>	(ITEP) JP	REFID=44646
LONGACRE	86	SJNP 43 776	R.S. Longacre <i>et al.</i>	(BNL, BRAN, CUNY+)	REFID=20768
ALTHOFF	83	Translated from YAF 43 1211.	M. Althoff <i>et al.</i>	(TASSO Collab.)	REFID=21408
ARMSTRONG	83B	PL B177 223	T.A. Armstrong <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20558
BINON	83	PL 121B 216	F.G. Binon <i>et al.</i>	(BARI, BIRM, CERN+)	REFID=20750
AGUILAR-...	81B	NP B224 193	M. Aguilar-Benitez <i>et al.</i>	(BELG, LAPP, SERP+)	REFID=21104
ALHARRAN	81	NC 78A 313	S. Al-Harran <i>et al.</i>	(CERN, CDEF+)	REFID=21403
CHABAUD	81	ZPHY C8 313	V. Chabaud <i>et al.</i>	(BIRM, CERN, GLAS+)	REFID=20742
COSTA	80	APP B12 575	G. Costa <i>et al.</i>	(CERN, CRAC, MPIM)	REFID=20737
GORLICH	80	NP B175 402	L. Gorlich <i>et al.</i>	(BARI, BONN, CERN, GLAS+)	REFID=20738
CORDEN	79	NP B174 16	M.J. Corden <i>et al.</i>	(CRAC, MPIM, CERN+)	REFID=20374
MARTIN	79	NP B157 250	A.D. Martin, E.N. Ozmutlu	(BIRM, RHEL, TELA+) JP	REFID=20377
POLYCHRO...	79	NP B158 520	V.A. Polychronakos <i>et al.</i>	(DURH)	REFID=20378
BARREIRO	77	PR D19 1317	F. Barreiro <i>et al.</i>	(NDAM, ANL)	REFID=21392
EVANGELIS...	77	NP B121 237	C. Evangelista <i>et al.</i>	(CERN, AMST, NIJM+)	REFID=20540
PAWLICKI	77	NP B127 384	A.J. Pawlicki <i>et al.</i>	(BARI, BONN, CERN+)	REFID=20367
BRANDENB...	76C	PR D15 3196	G.W. Brandenburg <i>et al.</i>	(ANL) IJP	REFID=20225
BEUSCH	75B	NP B104 413	W. Beusch <i>et al.</i>	(SLAC)	REFID=21390
HYAMS	75	PL 60B 101	B.D. Hyams <i>et al.</i>	(CERN, ETH)	REFID=20355
AGUILAR-...	72B	NP B100 205	M. Aguilar-Benitez <i>et al.</i>	(CERN, MPIM)	REFID=20205
AMMAR	67	PR D6 29	R. Ammar <i>et al.</i>	(BNL)	REFID=21382
BARNES	67	PRL 19 1071	V.E. Barnes <i>et al.</i>	(NWES, ANL) JP	REFID=21383
CRENNELL	66	PRL 19 964	D.J. Crennell <i>et al.</i>	(BNL, SYRA) IJPC	REFID=20317
		PRL 16 1025		(BNL) I	

$f_2(1565)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

OMITTED FROM SUMMARY TABLE

Seen mostly in antinucleon-nucleon annihilation. Needs confirmation in other channels.

NODE=M123

NODE=M123

 $f_2(1565)$ MASS

NODE=M123M

NODE=M123M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1542±19 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below.		
1552±13	¹ AMSLER	02	CBAR $0.9 \bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
1575±18	¹ BERTIN	98	OBLX $0.05-0.405 \bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1507±15	¹ BERTIN	97C	OBLX $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1560±15	² ANISOVICH	09	RVUE $0.0 \bar{p}p, \pi N$
1590±10	^{3,4} AMELIN	06	VES $36 \pi^- p \rightarrow \omega \omega n$
1550±10±20	⁴ AMELIN	00	VES $37 \pi^- p \rightarrow \eta \pi^+ \pi^- n$
1598±11±9	BAKER	99B	SPEC $0 \bar{p}p \rightarrow \omega \omega \pi^0$
1534±20	⁵ ABELE	96C	RVUE Compilation
~ 1552	⁶ AMSLER	95D	CBAR $0.0 \bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
1598±72	BALOSHIN	95	SPEC $40 \pi^- C \rightarrow K_S^0 K_S^0 X$
1566 ⁺⁸⁰ ₋₅₀	⁷ 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	⁸ ARMSTRONG	93C	E760 $\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
1508±10	⁸ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
1525±10	⁸ ARMSTRONG	93D	E760 $\bar{p}p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 1504	⁹ WEIDENAUER	93	ASTE $0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$
1540±15	⁸ ADAMO	92	OBLX $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
1515±10	¹⁰ AKER	91	CBAR $0.0 \bar{p}p \rightarrow 3\pi^0$
1565±20	MAY	90	ASTE $0.0 \bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
1477±5	BRIDGES	86C	DBC $0.0 \bar{p}N \rightarrow 3\pi^- 2\pi^+$

¹ T-matrix pole.² On sheet II in a two-pole solution.³ Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.⁴ Breit-Wigner width.⁵ T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.⁶ Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.⁷ From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.⁸ J^P not determined, could be partly $f_0(1500)$.⁹ J^P not determined.¹⁰ Superseded by AMSLER 95B.

OCCUR=2

NODE=M123M;LINKAGE=G

NODE=M123M;LINKAGE=AN

NODE=M123M;LINKAGE=AM

NODE=M123M;LINKAGE=D

NODE=M123M;LINKAGE=AA

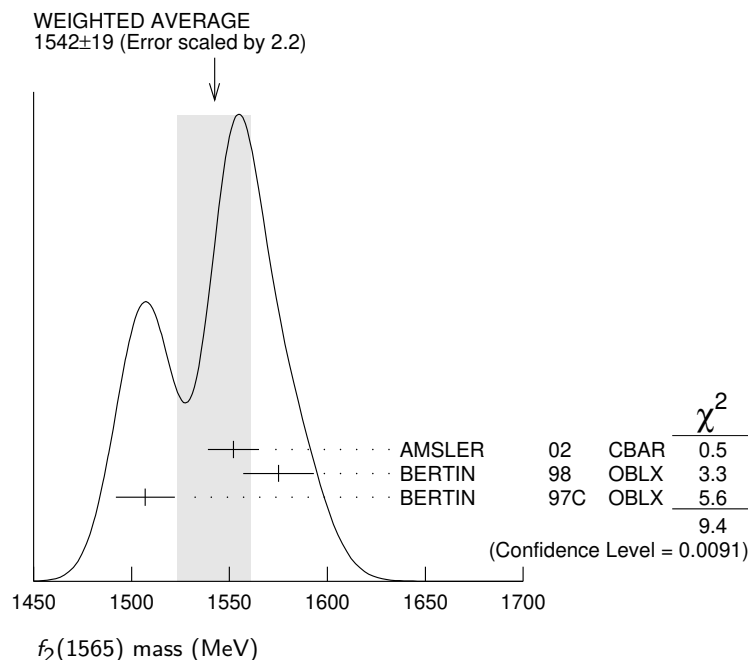
NODE=M123M;LINKAGE=AB

NODE=M123M;LINKAGE=C

NODE=M123M;LINKAGE=E

NODE=M123M;LINKAGE=F

NODE=M123M;LINKAGE=BA



$f_2(1565)$ WIDTH

NODE=M123W

NODE=M123W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
122± 13 OUR AVERAGE			
113± 23	11 AMSLER	02 CBAR	0.9 $\bar{p}p \rightarrow \pi^0 \eta \eta, \pi^0 \pi^0 \pi^0$
119± 24	11 BERTIN	98 OBLX	0.05-0.405 $\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
130± 20	11 BERTIN	97C OBLX	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
280± 40	12 ANISOVICH	09 RVUE	0.0 $\bar{p}p, \pi N$
140± 11	13,14 AMELIN	06 VES	36 $\pi^- p \rightarrow \omega \omega n$
130± 20±40	14 AMELIN	00 VES	37 $\pi^- p \rightarrow \eta \pi^+ \pi^- n$
180± 60	15 ABELE	96C RVUE	Compilation
~ 142	16 AMSLER	95D CBAR	0.0 $\bar{p}p \rightarrow \pi^0 \pi^0 \pi^0, \pi^0 \eta \eta, \pi^0 \pi^0 \eta$
263±101	BALOSHIN	95 SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$
166 ⁺ 80 - 20	17 ANISOVICH	94 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0, \eta \eta \pi^0$
130± 10	18 ADAMO	93 OBLX	$\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
148± 27	19 ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$
103± 15	19 ARMSTRONG	93D E760	$\bar{p}p \rightarrow 3\pi^0 \rightarrow 6\gamma$
111± 10	19 ARMSTRONG	93D E760	$\bar{p}p \rightarrow \eta \pi^0 \pi^0 \rightarrow 6\gamma$
~ 206	20 WEIDENAUER	93 ASTE	0.0 $\bar{p}N \rightarrow 3\pi^- 2\pi^+$
132± 37	19 ADAMO	92 OBLX	$\bar{n}p \rightarrow \pi^+ \pi^+ \pi^-$
120± 10	21 AKER	91 CBAR	0.0 $\bar{p}p \rightarrow 3\pi^0$
170± 40	MAY	90 ASTE	0.0 $\bar{p}p \rightarrow \pi^+ \pi^- \pi^0$
116± 9	BRIDGES	86C DBC	0.0 $\bar{p}N \rightarrow 3\pi^- 2\pi^+$

OCCUR=2

11 T-matrix pole.

12 On sheet II in a two-pole solution.

13 Supersedes the $\omega\omega$ state of BELADIDZE 92B earlier assigned to the $f_2(1640)$.

14 Breit-Wigner width.

15 T-matrix pole, large coupling to $\rho\rho$ and $\omega\omega$, could be $f_2(1640)$.

16 Coupled-channel analysis of AMSLER 95B, AMSLER 95C, and AMSLER 94D.

17 From a simultaneous analysis of the annihilations $\bar{p}p \rightarrow 3\pi^0, \pi^0 \eta \eta$ including AKER 91 data.

18 Supersedes ADAMO 92.

19 J^P not determined, could be partly $f_0(1500)$.20 J^P not determined.

21 Superseded by AMSLER 95B.

NODE=M123W;LINKAGE=G
 NODE=M123W;LINKAGE=AN
 NODE=M123W;LINKAGE=AM
 NODE=M123W;LINKAGE=H
 NODE=M123W;LINKAGE=CC
 NODE=M123W;LINKAGE=AB
 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

NODE=M123215;NODE=M123

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi$	seen
Γ_2 $\pi^+\pi^-$	seen
Γ_3 $\pi^0\pi^0$	seen
Γ_4 $\rho^0\rho^0$	seen
Γ_5 $2\pi^+2\pi^-$	seen
Γ_6 $\eta\eta$	seen
Γ_7 $\omega\omega$	seen
Γ_8 $K\bar{K}$	seen
Γ_9 $\gamma\gamma$	seen

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

NODE=M123225

$\Gamma(\eta\eta)$					Γ_6
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
1.2 ± 0.3	870	²² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M123W3
 NODE=M123W3

$\Gamma(K\bar{K})$					Γ_8
<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
2.0 ± 1.0	870	²² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M123W1
 NODE=M123W1

$\Gamma(\gamma\gamma)$					Γ_9
<u>VALUE (keV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.70 ± 0.14	870	²² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M123W2
 NODE=M123W2

²² 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.

NODE=M123W1;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	²³ 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=M123R1

²³ 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. ● ● ●				
$0.024 \pm 0.005 \pm 0.012$	²⁴ ARMSTRONG	93C	E760	$\bar{p}p \rightarrow \pi^0 \eta\eta \rightarrow 6\gamma$

NODE=M123R4
 NODE=M123R4

²⁴ J^P not determined, could be partly $f_0(1500)$.

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		
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>		
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)	

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REFID=41587
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REFID=40921
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REFID=21377

$\rho(1570)$

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

OMITTED FROM SUMMARY TABLE

May be an OZI-violating decay mode of $\rho(1700)$. See our mini-review under the $\rho(1700)$.

NODE=M188

NODE=M188

$\rho(1570)$ MASS

NODE=M188M

NODE=M188M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$1570 \pm 36 \pm 62$	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. ● ● ●				
1480 ± 40		² BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$
¹ From the fit with two resonances. ² Systematic errors not estimated.				

NODE=M188M;LINKAGE=AU
NODE=M188M;LINKAGE=BI

$\rho(1570)$ WIDTH

NODE=M188W

NODE=M188W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$144 \pm 75 \pm 43$	54	³ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
130 ± 60		⁴ BITYUKOV	87 SPEC	$32.5 \pi^- p \rightarrow \phi \pi^0 n$
³ From the fit with two resonances. ⁴ Systematic errors not estimated.				

NODE=M188W;LINKAGE=AU
NODE=M188W;LINKAGE=BI

$\rho(1570)$ DECAY MODES

NODE=M188215;NODE=M188

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad e^+ e^-$	
$\Gamma_2 \quad \phi \pi$	not seen
$\Gamma_3 \quad \omega \pi$	

DESIG=1
DESIG=2
DESIG=3

$\rho(1570) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$								
$\Gamma(\phi\pi) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$			$\Gamma_2\Gamma_1/\Gamma$					
VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT			
3.5±0.9±0.3		54	⁵ 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		⁶ AULCHENKO	87B ND	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0$			
⁵ From the fit with two resonances.								
⁶ Using mass and width of BITYUKOV 87.								

NODE=M188225

NODE=M188G01
NODE=M188G01

NODE=M188G01;LINKAGE=AU
NODE=M188G01;LINKAGE=AL

$\rho(1570) \text{ BRANCHING RATIOS}$					Γ_2/Γ
$\Gamma(\phi\pi)/\Gamma_{\text{total}}$			DOCUMENT ID	TECN	COMMENT
VALUE					
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			⁷ DONNACHIE	91 RVUE	
⁷ Using data from BISELLO 91B, DOLINSKY 86, and ALBRECHT 87L.					

NODE=M188220

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

$\rho(1570) \text{ REFERENCES}$				
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)

NODE=M188

REFID=52242
REFID=45765
REFID=41752
REFID=41632
REFID=40418
REFID=41373

REFID=40011
REFID=20246

NODE=M166

$h_1(1595)$

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

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

$h_1(1595) \text{ MASS}$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
$1594 \pm 15^{+10}_{-60}$	EUGENIO	01 SPEC	$18 \pi^- p \rightarrow \omega\eta n$	

NODE=M166M

NODE=M166M

$h_1(1595) \text{ WIDTH}$				
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT	
$384 \pm 60^{+70}_{-100}$	EUGENIO	01 SPEC	$18 \pi^- p \rightarrow \omega\eta n$	

NODE=M166W

NODE=M166W

$h_1(1595) \text{ DECAY MODES}$		
Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad \omega\eta$	seen	

NODE=M166215;NODE=M166

DESIG=1;OUR EST;→ UNCHECKED ←

$h_1(1595) \text{ REFERENCES}$			
EUGENIO	01	PL B497 190	P. Eugenio <i>et al.</i>

NODE=M166

REFID=48010

$\pi_1(1600)$

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

See the review on "Non- $q\bar{q}$ Mesons" and a note in PDG 06, Journal of Physics **G33** 1 (2006).

NODE=M164

NODE=M164

NODE=M164M

NODE=M164M

 $\pi_1(1600)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1660⁺¹⁵₋₁₁ OUR AVERAGE Error includes scale factor of 1.2.

1564 [±] 24 [±] 86		¹ RODAS	19 JPAC	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1600 ⁺¹¹⁰ ₋₆₀	46M	² AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1664 [±] 8 [±] 10	145k	³ LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1709 [±] 24 [±] 41	69k	⁴ KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
1597 [±] 10 ⁺⁴⁵ ₋₁₀		⁴ 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	⁵ ALEKSEEV	10 COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
1593 [±] 8 ⁺²⁹ ₋₄₇		^{4,6} ADAMS	98B B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15data. The mass is extracted from the T-matrix pole.

² Statistical error negligible.

³ May be a different state: natural and unnatural parity exchanges.

⁴ Natural parity exchange.

⁵ Superseded by AGHASYAN 2018B.

⁶ 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=M164M;LINKAGE=D

NODE=M164M;LINKAGE=B

NODE=M164M;LINKAGE=LU

NODE=M164M;LINKAGE=A

NODE=M164M;LINKAGE=C

NODE=M164M;LINKAGE=DZ

 $\pi_1(1600)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

257[±] 60 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

492 [±] 54 [±] 102		¹ RODAS	19 JPAC	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
580 ⁺¹⁰⁰ ₋₂₃₀	46M	² AGHASYAN	18B COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
185 [±] 25 [±] 28	145k	³ LU	05 B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
403 [±] 80 [±] 115	69k	⁴ KUHN	04 B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$
340 [±] 40 [±] 50		⁴ IVANOV	01 B852	18 $\pi^- p \rightarrow \eta' \pi^- p$

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

269 [±] 21 ⁺⁴² ₋₆₄	420k	⁵ ALEKSEEV	10 COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
168 [±] 20 ⁺¹⁵⁰ ₋₁₂		^{4,6} ADAMS	98B B852	18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

¹ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15data. The width is extracted from the T-matrix pole.

² Statistical error negligible.

³ May be a different state: natural and unnatural parity exchanges.

⁴ Natural parity exchange.

⁵ Superseded by AGHASYAN 2018B.

⁶ 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

NODE=M164W

NODE=M164W;LINKAGE=D

NODE=M164W;LINKAGE=B

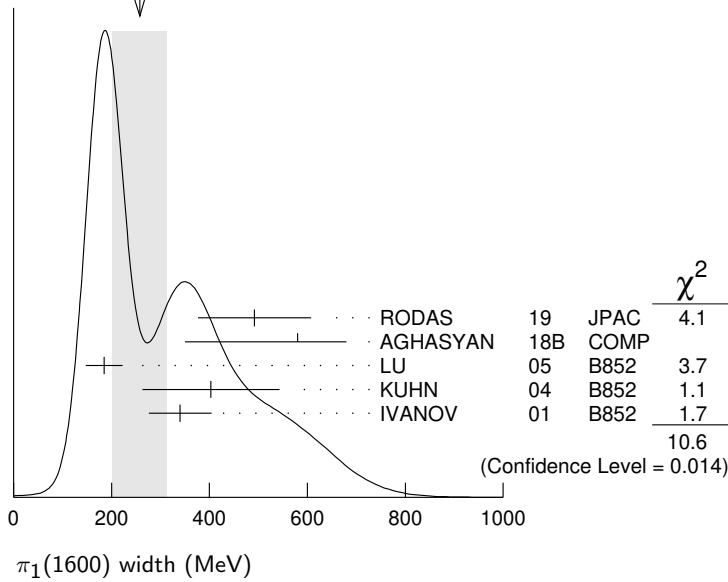
NODE=M164W;LINKAGE=LU

NODE=M164W;LINKAGE=A

NODE=M164W;LINKAGE=C

NODE=M164W;LINKAGE=DZ

WEIGHTED AVERAGE
257±60 (Error scaled by 1.9)



$\pi_1(1600)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi\pi\pi$	seen
Γ_2 $\rho^0\pi^-$	seen
Γ_3 $f_2(1270)\pi^-$	not seen
Γ_4 $b_1(1235)\pi$	seen
Γ_5 $\eta'(958)\pi^-$	seen
Γ_6 $f_1(1285)\pi$	seen

NODE=M164215;NODE=M164

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2
DESIG=4
DESIG=5
DESIG=3
DESIG=6;OUR EST;→ UNCHECKED ←

$\pi_1(1600)$ BRANCHING RATIOS

$\Gamma(\rho^0\pi^-)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
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=M164220

NODE=M164R1
NODE=M164R1

NODE=M164R1;LINKAGE=DZ

$\Gamma(f_2(1270)\pi^-)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ
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

$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
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

$\Gamma(\eta'(958)\pi^-)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
seen		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$

NODE=M164R2
NODE=M164R2

$\Gamma(f_1(1285)\pi)/\Gamma(\eta'(958)\pi^-)$

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

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.)
DZIERBA	06	PR D73 072001	A.R. Dzierba <i>et al.</i>	(BNL E852 Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG 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.)
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.)
IVANOV	01	PRL 86 3977	E.I. Ivanov <i>et al.</i>	(BNL E852 Collab.)
ADAMS	98B	PRL 81 5760	G.S. Adams <i>et al.</i>	(BNL E852 Collab.)

NODE=M164

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REFID=51077
REFID=51004
REFID=50459
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REFID=49414
REFID=48837
REFID=48317
REFID=46610

$a_1(1640)$

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

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

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 $\bar{p}p \rightarrow 4\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1670± 90		BELLINI	85 SPEC	40 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

¹ Statistical error negligible.

² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161M

NODE=M161M

NODE=M161M;LINKAGE=A
NODE=M161M;LINKAGE=KB

 $a_1(1640)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
254± 40 OUR AVERAGE		Error includes scale factor of 1.8. See the ideogram below.		
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 $\pi^- A \rightarrow \pi^- \pi^+ \pi^- A$

¹ Statistical error negligible.

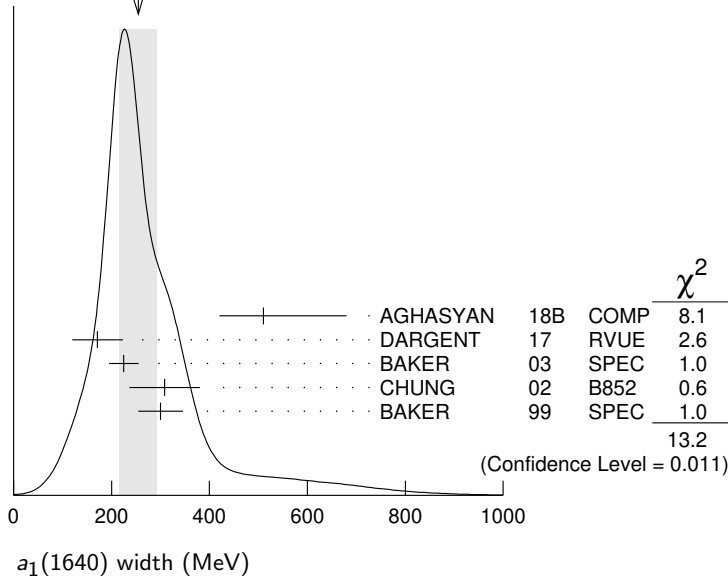
² Using the $a_1(1260)$ mass and width results of BOWLER 88.

NODE=M161W

NODE=M161W

NODE=M161W;LINKAGE=A
NODE=M161W;LINKAGE=KB

WEIGHTED AVERAGE
254±40 (Error scaled by 1.8)



$a_1(1640)$ DECAY MODES

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

NODE=M161215;NODE=M161

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

$\Gamma(f_2(1270)\pi)/\Gamma(\sigma\pi)$					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=M161220

NODE=M161R1
 NODE=M161R1

$\Gamma(\rho\pi$ D-wave)/ Γ_{total}					Γ_5/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		

NODE=M161R2
 NODE=M161R2

• • • 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 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

$\Gamma(\omega\pi\pi)/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M161R3
 NODE=M161R3

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

seen	35280	¹ BAKER	03	SPEC	$\bar{p}p \rightarrow \omega\pi^+ \pi^- \pi^0$

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		

NODE=M161R4
 NODE=M161R4

• • • 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 $\pi^- p \rightarrow K^+ \bar{K}^0 \pi^- \pi^- p$

$\Gamma(a_1(1260)\eta)/\Gamma_{\text{total}}$					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. d'Argent <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

 $f_2(1640)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

NODE=M117

OMITTED FROM SUMMARY TABLE

 $f_2(1640)$ MASS

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

NODE=M117M;LINKAGE=BB

 $f_2(1640)$ WIDTH

NODE=M117W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
99^{+60}_{-40} OUR AVERAGE	Error includes scale factor of 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 $38 \pi^- p \rightarrow \omega \omega n$

NODE=M117W

 $f_2(1640)$ DECAY MODES

NODE=M117215;NODE=M117

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega \omega$	seen
Γ_2 4π	seen
Γ_3 $K \bar{K}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3

 $f_2(1640)$ BRANCHING RATIOS

NODE=M117220

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	Γ_3/Γ			
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	AMSLER	06	CBAR	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M117R2
NODE=M117R2

 $f_2(1640)$ 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. • • •				
1651± 3 ⁺¹⁶ ₋₆	183k	1 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	2 AKHMETSHIN	17A CMD3	$1.4-2.0 e^+ e^- \rightarrow \omega \eta$
1660± 10	898	3 ACHASOV	16B SND	$1.34-2.00 e^+ e^- \rightarrow \omega \eta$
1680± 10	13.1k	4 AULCHENKO	15A SND	$1.05-1.80 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
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	5 ACHASOV	03D RVUE	$0.44-2.00 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1619± 5		6 HENNER	02 RVUE	$1.2-2.0 e^+ e^- \rightarrow \rho \pi,$ $\omega \pi \pi$
1700± 20		EUGENIO	01 SPEC	$18 \pi^- p \rightarrow \omega \eta n$
1705± 26	612	7 AKHMETSHIN	00D CMD2	$e^+ e^- \rightarrow \omega \pi^+ \pi^-$
1820 ⁺¹⁹⁰ ₋₁₅₀		8 ACHASOV	98H RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- \pi^0$
1840 ⁺¹⁰⁰ ₋₇₀		9 ACHASOV	98H RVUE	$e^+ e^- \rightarrow \omega \pi^+ \pi^-$
1780 ⁺¹⁷⁰ ₋₃₀₀		10 ACHASOV	98H RVUE	$e^+ e^- \rightarrow K^+ K^-$
~ 2100		11 ACHASOV	98H RVUE	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1606± 9		12 CLEGG	94 RVUE	
1662± 13	750	13 ANTONELLI	92 DM2	$1.34-2.4 e^+ e^- \rightarrow \rho \pi,$ $\omega \pi \pi$
1670± 20		ATKINSON	83B OMEG	$20-70 \gamma p \rightarrow 3 \pi X$
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 Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X \pi^0 \rightarrow K^+ K^- \pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

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 $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁴ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

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 Using data from BARKOV 87, DOLINSKY 91, and ANTONELLI 92.

⁹ Using the data from ANTONELLI 92.

¹⁰ Using the data from IVANOV 81 and BISELLO 88B.

¹¹ Using the data from BISELLO 91C.

¹² From a fit to two Breit-Wigner functions and using the data of DOLINSKY 91 and ANTONELLI 92.

¹³ From the combined fit of the $\rho \pi$ and $\omega \pi \pi$ final states.

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

NODE=M126M;LINKAGE=AE

 $\omega(1650)$ WIDTH

NODE=M126W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
315± 35 OUR ESTIMATE				

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

194± 8 ⁺¹⁵ ₋₇	183k	1 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	2 AKHMETSHIN	17A CMD3	$1.4-2.0 e^+ e^- \rightarrow \omega \eta$

NODE=M126W

→ UNCHECKED ←

110± 20	898	³ ACHASOV	16B	SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
310± 30	13.1k	⁴ 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 ⁺²⁰⁰ _{–150} ±130	1.2M	⁵ ACHASOV	03D	RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
250± 14		⁶ 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	⁷ AKHMETSHIN	00D	CMD2	$e^+e^- \rightarrow \omega\pi^+\pi^-$
113± 20		⁸ CLEGG	94	RVUE	
280± 24	750	⁹ 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	$e^+e^- \rightarrow 3\pi$

OCCUR=2
OCCUR=5
OCCUR=4

¹ Could also be $\rho(1700)$. Branching ratio $J/\psi \rightarrow X\pi^0 \rightarrow K^+K^-\pi^0 = (5.3 \pm 0.3^{+0.6}_{-0.5}) \times 10^{-5}$.

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 $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

⁴ From a fit with contributions from $\omega(782)$, $\phi(1020)$, $\omega(1420)$, and $\omega(1650)$.

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 the combined fit of the $\rho\pi$ and $\omega\pi\pi$ final states.

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

$\omega(1650)$ DECAY MODES

NODE=M126215;NODE=M126

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi$	seen
Γ_2 $\omega\pi\pi$	seen
Γ_3 $\omega\eta$	seen
Γ_4 e^+e^-	seen
Γ_5 $\pi^0\gamma$	not seen

DESIG=1;OUR EST;→ UNCHECKED ←
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

$\Gamma(\rho\pi)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_1/\Gamma \times \Gamma_4/\Gamma$
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} _{–0.1} ±0.8	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 $\omega(1650)$.

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

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

$$\Gamma_2/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
7.0 $\pm$ 0.5		AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow \omega\pi^+\pi^-\gamma$
4.1 $\pm$ 0.9 $\pm$ 1.3	1.2M	^{1,2} ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
5.40 $\pm$ 0.95		³ AKHMETSHIN	00D CMD2	1.2–1.38 $e^+e^- \rightarrow \omega\pi^+\pi^-$
3.18 $\pm$ 0.80		^{4,5} CLEGG	94 RVUE	
6.07 $\pm$ 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
NODE=M126G4

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

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

$$\Gamma_3/\Gamma \times \Gamma_4/\Gamma$$

VALUE (units 10^{-7})	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.62 ^{+0.45} _{-0.42}		ACHASOV	19 SND	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta$
4.5 $\pm$ 0.3 $\pm$ 0.3	824	¹ AKHMETSHIN	17A CMD3	1.4–2.0 $e^+e^- \rightarrow \omega\eta$
4.4 $\pm$ 0.5	898	² ACHASOV	16B SND	1.34–2.00 $e^+e^- \rightarrow \omega\eta$
5.7 $\pm$ 0.6	13	AUBERT	06D BABR	10.6 $e^+e^- \rightarrow \omega\eta\gamma$
< 60 at 90% CL		³ AKHMETSHIN	03B CMD2	$e^+e^- \rightarrow \eta\pi^0\gamma$

¹ 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 $\Gamma(\omega(1650) \rightarrow \omega\eta)/\Gamma_{\text{total}} \times \Gamma(\omega(1650) \rightarrow e^+e^-) = 51 \pm 3 \text{ eV}$.

² From a fit with contributions from $\omega(1420)$, $\omega(1650)$, and $\phi(1680)$.

³ $\omega(1650)$ mass and width fixed at 1700 MeV and 250 MeV, respectively.

NODE=M126G5
NODE=M126G5

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	¹ ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.380 $\pm$ 0.014		² HENNER	02 RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ 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.

² Assuming 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

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

$$\Gamma_2/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
~ 0.35	1.2M	¹ ACHASOV	03D RVUE	0.44–2.00 $e^+e^- \rightarrow \pi^+\pi^-\pi^0$
0.620 $\pm$ 0.014		² HENNER	02 RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ 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.

² Assuming 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

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

$$\Gamma_4/\Gamma$$

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 $\pm$ 1		² HENNER	02 RVUE	1.2–2.0 $e^+e^- \rightarrow \rho\pi, \omega\pi\pi$

¹ Calculated by us from the cross section at the peak.

² Assuming that the $\omega(1650)$ decays into $\rho\pi$ and $\omega\pi\pi$ only.

NODE=M126R4
NODE=M126R4

NODE=M126R;LINKAGE=AW
NODE=M126R4;LINKAGE=AC

$\Gamma(\pi^0\gamma)/\Gamma_{\text{total}}$ Γ_5/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=M126R00
NODE=M126R00

NODE=M126R00;LINKAGE=A

 $\omega(1650)$ REFERENCES

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.)
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=59909
REFID=59887
REFID=58239
REFID=57537
REFID=56843

REFID=59494
REFID=52049
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REFID=47391
REFID=46323
REFID=44081
REFID=43168
REFID=41867
REFID=41369
REFID=40581
REFID=40280

NODE=M045

 $\omega_3(1670)$

$$I^G(J^{PC}) = 0^-(3^--)$$

 $\omega_3(1670)$ MASS

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	$8.2 K^- p \text{ backward}$
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

NODE=M045M

OCCUR=2

NODE=M045M;LINKAGE=E
NODE=M045M;LINKAGE=P

 $\omega_3(1670)$ WIDTH

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	$8.2 K^- p \text{ backward}$
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	$7.0 \pi^+ n \rightarrow p 3\pi^0$

NODE=M045W

NODE=M045W

OCCUR=2

• • • 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	$5.1 \pi^+ n \rightarrow p 3\pi^0$

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

⁴Phase rotation seen for $J^P = 3^- \rho\pi$ wave.

⁵From a fit to $I(J^P) = 0(3^-) \rho\pi$ partial wave.

NODE=M045W;LINKAGE=S
NODE=M045W;LINKAGE=E
NODE=M045W;LINKAGE=P

$\omega_3(1670)$ DECAY MODES

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

NODE=M045215;NODE=M045

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←

$\omega_3(1670)$ BRANCHING RATIOS

$\Gamma(\omega\pi\pi)/\Gamma(\rho\pi)$					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=M045220

NODE=M045R3
NODE=M045R3

NODE=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

$\pi_2(1670)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M034

 $\pi_2(1670)$ MASS

NODE=M034M

NODE=M034M

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 $\pi^- P b \rightarrow$ $\pi^- \pi^- \pi^+ P b'$
1730	± 20		⁶ AMELIN	95B	VES	36 $\pi^- A \rightarrow$ $\pi^+ \pi^- \pi^- A$
1742	± 31 ± 49		ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow$ $e^+ e^- \pi^0 \pi^0 \pi^0$
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.

⁹ From a two-resonance fit to four $2^- 0^+$ waves. This should not be averaged with all the single resonance fits.

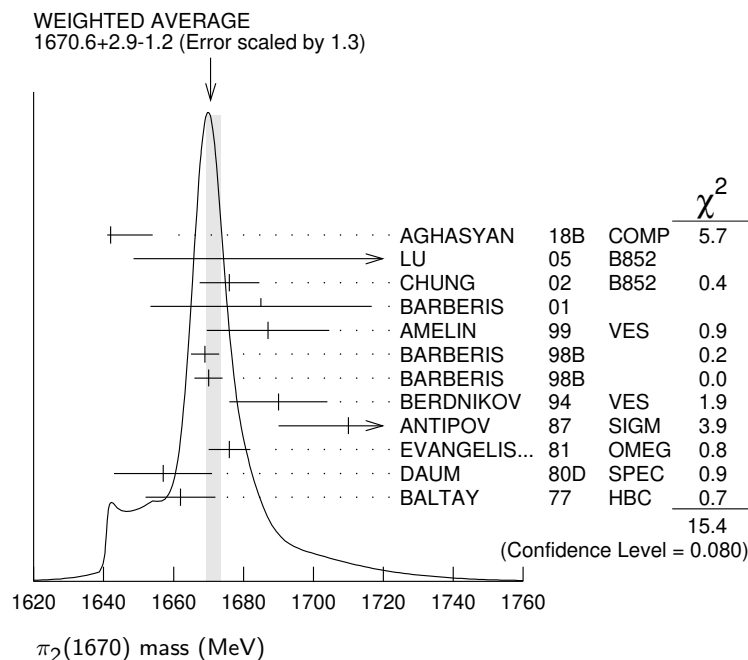
OCCUR=2

OCCUR=2

OCCUR=3

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
NODE=M034M;LINKAGE=L



$\pi_2(1670)$ WIDTH

NODE=M034W

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT

NODE=M034W

258⁺⁸₋₉ OUR AVERAGE

Error includes scale factor of 1.2.

311 ⁺¹² ₋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 $p p \rightarrow p_f 3 \pi^0 p_s$
168 $\pm$ 43 $\pm$ 53			AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$
268 $\pm$ 15			BARBERIS	98B		450 $p p \rightarrow p_f \rho \pi p_s$
256 $\pm$ 15			BARBERIS	98B		450 $p p \rightarrow p_f f_2(1270) \pi p_s$
190 $\pm$ 50		12	BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
170 $\pm$ 80	700		ANTIPOV	87	SIGM	50 $\pi^- \text{Cu} \rightarrow \mu^+ \mu^- \pi^- \text{Cu}$
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 $\pi^- P b \rightarrow \pi^- \pi^- \pi^+ P b'$
310 $\pm$ 20		15	AMELIN	95B	VES	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$
236 $\pm$ 49 $\pm$ 36			ANTREASYAN	90	CBAL	$e^+ e^- \rightarrow e^+ e^- \pi^0 \pi^0$
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 $\pi^- p \rightarrow p \pi_2$

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.

OCCUR=2

OCCUR=2

OCCUR=3

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

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=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 $\pi(\pi\pi)_S$ -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} $\eta 3\pi$		
Γ_{18} $f_1(1285)\pi$	possibly seen	
Γ_{19} $a_2(1320)\pi$	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=24
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 $\pi^-\text{Pb} \rightarrow \pi^+\pi^-\pi^-\text{Pb}'$	
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
NODE=M034W2

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

NODE=M034W1
NODE=M034W1

OCCUR=2

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;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

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

$$\Gamma_3 / \Gamma_2$$

VALUE	DOCUMENT ID	COMMENT
0.29 ± 0.03 ± 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 ± 0.07 ± 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

$$\Gamma(\sigma\pi) / \Gamma(f_2(1270)\pi)$$

$$\Gamma_6 / \Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.17 ± 0.02 ± 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

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

$$\Gamma_{10} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.027 ± 0.004 ± 0.010	²⁸ AMELIN 99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

NODE=M034R17
NODE=M034R17

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

(All η decays.)

$$\Gamma_{13}/\Gamma_8 = \Gamma_{13}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$$

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

$$\Gamma(\pi^{\pm}2\pi^{+}2\pi^{-})/\Gamma(\pi^{\pm}\pi^{+}\pi^{-})$$

$$\Gamma_{14}/\Gamma_8 = \Gamma_{14}/(0.565\Gamma_4 + \frac{1}{2}\Gamma_5 + 0.624\Gamma_7)$$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>CHG</u>	<u>COMMENT</u>	
<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

$$\Gamma(\rho(1450)\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{15}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0036	97.7	AMELIN	99	VES
37 $\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$				

NODE=M034R18

NODE=M034R18

$$\Gamma(b_1(1235)\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{16}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0019	97.7	AMELIN	99	VES
37 $\pi^{-}A \rightarrow \omega\pi^{-}\pi^0A^{*}$				

NODE=M034R19

NODE=M034R19

$$\Gamma(f_1(1285)\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma$$

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

$$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma$$

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

$$D\text{-wave}/S\text{-wave RATIO FOR } \pi_2(1670) \rightarrow f_2(1270)\pi$$

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

$$F\text{-wave}/P\text{-wave RATIO FOR } \pi_2(1670) \rightarrow \rho\pi$$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.72±0.07±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.)
ACCARI	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				
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. Kalelkar	(COLU) JP
ASCOLI	73	PR D7 669	G. Ascoli	(ILL, TINTO, GENO, HAMB, MILA+) JP
CRENNELL	70	PRL 24 781	D.J. Crennell <i>et al.</i>	(BNL)
ARMENISE	69	LCN 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

REFID=53356

REFID=51186

REFID=50459

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REFID=20689

REFID=21531

REFID=21532

$\phi(1680)$

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

NODE=M067

 $\phi(1680)$ 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. • • •

$1680^{+12}_{-13} \pm 21$	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1641^{+24}_{-18}		ACHASOV	19	SND	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0 \eta$
$1667 \pm 5 \pm 11$	3k	² IVANOV	19A	CMD3	$1.59-2.007 e^+e^- \rightarrow K^+ K^- \eta$
1700 ± 23	2k	³ ACHASOV	18A	SND	$1.3-2.0 e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
$1674 \pm 12 \pm 6$	6.2k	⁴ LEES	14H	BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
$1733 \pm 10 \pm 10$		⁵ LEES	12F	BABR	$10.6 e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
$1689 \pm 7 \pm 10$	4.8k	⁶ SHEN	09	BELL	$10.6 e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
$1709 \pm 20 \pm 43$		⁷ AUBERT	08S	BABR	$10.6 e^+e^- \rightarrow \text{hadrons}$
1623 ± 20	948	⁸ AKHMETSHIN	03	CMD2	$1.05-1.38 e^+e^- \rightarrow K_L^0 K_S^0$
~ 1500		⁹ ACHASOV	98H	RVUE	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0, \omega \pi^+ \pi^-,$ $K^+ K^-$
~ 1900		¹⁰ ACHASOV	98H	RVUE	$e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$
1700 ± 20		¹¹ 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		¹² BISELLO	88B	DM2	$e^+e^- \rightarrow K^+ K^-$
1680 ± 10		¹³ BUON	82	DM1	$e^+e^- \rightarrow \text{hadrons}$
1677 ± 12		¹⁴ MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K \pi$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (12.0 \pm 1.3^{+6.5}_{-6.9}) \times 10^{-6}$.

² From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

³ Assuming the $K \bar{K}^*(892) + \text{c.c.}$ dynamics. Systematic uncertainties not estimated.

⁴ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

⁵ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

⁶ From a fit with two incoherent Breit-Wigners.

⁷ 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.

⁸ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.

⁹ Using data from IVANOV 81, BARKOV 87, BISELLO 88B, DOLINSKY 91, and AN-TONELLI 92.

¹⁰ Using the data from BISELLO 91C.

¹¹ Using BISELLO 88B and MANE 82 data.

¹² From global fit including ρ , ω , ϕ and $\rho(1700)$ assume mass 1570 MeV and width 510 MeV for ρ radial excitation.

¹³ 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.

¹⁴ Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

OCCUR=4

NODE=M067M1;LINKAGE=E

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=M067M2

NODE=M067M2

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

1753 ± 3	¹ LINK	02K	FOCS	$20-160 \gamma p \rightarrow K^+ K^- p$
1726 ± 22	¹ BUSENITZ	89	TPS	$\gamma p \rightarrow K^+ K^- X$
1760 ± 20	¹ ATKINSON	85C	OMEG	$20-70 \gamma p \rightarrow K \bar{K} X$
1690 ± 10	¹ ASTON	81F	OMEG	$25-70 \gamma p \rightarrow K^+ K^- X$

¹ We list here a state decaying into $K^+ K^-$ possibly different from $\phi(1680)$.

NODE=M067M2;LINKAGE=LK

 $p\bar{p}$ 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	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

¹ Could also be $\rho(1700)$.

NODE=M067M3

NODE=M067M3

NODE=M067M3;LINKAGE=AM

$\phi(1680)$ WIDTH

NODE=M067210

 e^+e^- PRODUCTION

VALUE (MeV)	EVS	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. • • •

185 ⁺³⁰ ₋₂₆ + 25 ₋₄₇ 1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
103 ⁺²⁶ ₋₂₄	ACHASOV	19	SND	$e^+e^- \rightarrow \pi^+ \pi^- \pi^0 \eta$
176±23± 38 3k	² IVANOV	19A	CMD3	1.59–2.007 $e^+e^- \rightarrow K^+ K^- \eta$
300±50 2k	³ ACHASOV	18A	SND	1.3–2.0 $e^+e^- \rightarrow K_S^0 K_L^0 \pi^0$
165±38± 70 6.2k	⁴ LEES	14H	BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$
300±15± 37	⁵ LEES	12F	BABR	10.6 $e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
211±14± 19 4.8k	⁶ SHEN	09	BELL	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
322±77±160	⁷ AUBERT	08S	BABR	10.6 $e^+e^- \rightarrow \text{hadrons}$
139±60 948	⁸ AKHMETSHIN	03	CMD2	1.05–1.38 $e^+e^- \rightarrow K_L^0 K_S^0$
300±60	⁹ 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	¹⁰ BISELLO	88B	DM2	$e^+e^- \rightarrow K^+ K^-$
185±22	¹¹ BUON	82	DM1	$e^+e^- \rightarrow \text{hadrons}$
102±36	¹² MANE	82	DM1	$e^+e^- \rightarrow K_S^0 K \pi$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (12.0 \pm 1.3_{-6.9}^{+6.5}) \times 10^{-6}$.

² From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

³ Assuming the $K \bar{K}^*(892) + \text{c.c.}$ dynamics. Systematic uncertainties not estimated.

⁴ Using a vector meson dominance model with contribution from $\phi(1020)$, $\phi(1680)$, and higher mass excitations of $\rho(770)$ and $\omega(782)$.

⁵ Using events with $\pi\pi$ invariant mass less than 0.85 GeV.

⁶ From a fit with two incoherent Breit-Wigners.

⁷ 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.

⁸ From the combined fit of AKHMETSHIN 03 and MANE 81 also including ρ , ω , and ϕ . Neither isospin nor flavor structure known.

⁹ Using BISELLO 88B and MANE 82 data.

¹⁰ From global fit including ρ , ω , ϕ and $\rho(1700)$

¹¹ 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.

¹² Fit to one channel only, neglecting interference with ω , $\rho(1700)$.

NODE=M067W1;LINKAGE=E

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

PHOTOPRODUCTION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

122±63	¹ LINK	02K	FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$
121±47	¹ BUSENITZ	89	TPS	$\gamma p \rightarrow K^+ K^- X$
80±40	¹ ATKINSON	85C	OMEG	20–70 $\gamma p \rightarrow K \bar{K} X$
100±40	¹ ASTON	81F	OMEG	25–70 $\gamma p \rightarrow K^+ K^- X$

¹ We list here a state decaying into $K^+ K^-$ possibly different from $\phi(1680)$.

NODE=M067W2;LINKAGE=LK

 $p\bar{p}$ ANNIHILATION

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

143±24	¹ AMSLER	06	CBAR	0.9 $\bar{p} p \rightarrow K^+ K^- \pi^0$

¹ Could also be $\rho(1700)$.

NODE=M067W3

NODE=M067W3

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} $K^+K^-\eta$	
Γ_{11} $\eta\gamma$	seen
Γ_{12} $K^+K^-\pi^0$	

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=14
 DESIG=13
 DESIG=2

 $\phi(1680) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M067220

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

 $\Gamma(K_L^0 K_S^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$14.3 \pm 2.4 \pm 6.2$	6.2k	¹ LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_L^0 \gamma$

NODE=M067A00
 NODE=M067A00

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;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. • • •			
$4.2 \pm 0.2 \pm 0.3$	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. • • •				
$94 \pm 13 \pm 15$	3k	¹ IVANOV	19A CMD3	$1.59\text{--}2.007 e^+e^- \rightarrow K^+K^-\eta$

NODE=M067R00
 NODE=M067R00

¹ From a fit with coherent interference of the $\phi(1680)$ with a non-resonant contribution.

NODE=M067R00;LINKAGE=A

 $\phi(1680) \Gamma(i)\Gamma(e^+e^-)/\Gamma^2(\text{total})$

NODE=M067223

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

 $\Gamma(K_L^0 K_S^0)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma \times \Gamma_5/\Gamma$

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	$1.05\text{--}1.38 e^+e^- \rightarrow K_L^0 K_S^0$

NODE=M067G5
 NODE=M067G5

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=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. • • •				
$1.15 \pm 0.16 \pm 0.01$		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	$1.35\text{--}2.40 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M067G6
 NODE=M067G6

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.

NODE=M067G6;LINKAGE=AU

² Recalculated by us with the published value of $B(K\bar{K}^*(892) + \text{c.c.}) \times \Gamma(e^+e^-)$.

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 ± 0.6 ± 0.9 3k ¹ IVANOV 19A CMD3 1.59–2.007 $e^+e^- \rightarrow K^+K^-\eta$ |
 4.3 ± 1.0 ± 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 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$ |

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

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

$$\Gamma_{11}/\Gamma$$

VALUE EVTS DOCUMENT ID TECN COMMENT

seen 35 ¹ ACHASOV 14 SND 1.15–2.00 $e^+e^- \rightarrow \eta\gamma$ |

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

$\phi(1680)$ REFERENCES

NODE=M067

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
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.)	REFID=52242
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AMSLER	06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)	REFID=51136
AKHMETSHIN	03	PL B551 27	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49172
Also		PAN 65 1222	E.V. Anashkin, V.M. Aulchenko, R.R. Akhmetshin		REFID=48827
Translated from YAF 65 1255.					

LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS 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)
BUSENITZ	89	PR D40 1	J.K. Busenitz <i>et al.</i>	(ILL, FNAL)
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	85C	ZPHY C27 233	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)
MANE	82	PL 112B 178	F. Mane <i>et al.</i>	(LALO)
ASTON	81F	PL 104B 231	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)
IVANOV	81	PL 107B 297	P.M. Ivanov <i>et al.</i>	(NOVO)
MANE	81	PL 99B 261	F. Mane <i>et al.</i>	(ORSAY)

REFID=48845
REFID=46323
REFID=44081
REFID=43168
REFID=41867
REFID=41369
REFID=40927
REFID=40581
REFID=40280

REFID=21596
REFID=21494
REFID=21590
REFID=21585
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) $^\pm$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

NODE=M015M3
 NODE=M015M3

1686 $\pm$ 5 OUR AVERAGE Error includes scale factor of 1.1.

1694 $\pm$ 6		⁸ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1665 $\pm$ 15	177	BALTAY	78B	HBC	+	15 $\pi^+ p \rightarrow p4\pi$
1670 $\pm$ 10		THOMPSON	74	HBC	+	13 $\pi^+ p$
1687 $\pm$ 20		CASON	73	HBC	—	8,18.5 $\pi^- p$
1685 $\pm$ 14		⁹ CASON	73	HBC	—	8,18.5 $\pi^- p$
1680 $\pm$ 40	144	BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N4\pi$
1689 $\pm$ 20	102	⁹ BARTSCH	70B	HBC	+	8 $\pi^+ p \rightarrow N2\rho$
1705 $\pm$ 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 $\pm$ 10		¹⁰ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1673 $\pm$ 9		¹¹ EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow p4\pi$
1733 $\pm$ 9	66	⁹ KLIGER	74	HBC	—	4.5 $\pi^- p \rightarrow p4\pi$
1630 $\pm$ 15		HOLMES	72	HBC	+	10–12 $K^+ p$
1720 $\pm$ 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 $\pm$ 7 OUR AVERAGE

1670 $\pm$ 25		¹² ALDE	95	GAM2		38 $\pi^- p \rightarrow \omega\pi^0 n$
1690 $\pm$ 15		EVANGELIS...	81	OMEG	—	12 $\pi^- p \rightarrow \omega\pi p$
1666 $\pm$ 14		GESSAROLI	77	HBC		11 $\pi^- p \rightarrow \omega\pi p$
1686 $\pm$ 9		THOMPSON	74	HBC	+	13 $\pi^+ p$

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

1654 $\pm$ 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 $\pm$ 12 OUR AVERAGE

1685 $\pm$ 10 $\pm$ 20	AMELIN	00	VES		37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
1680 $\pm$ 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 $\pm$ 47	¹³ ANDERSON	69	MMS	—	16 $\pi^- p$ backward
1632 $\pm$ 15	^{13,14} FOCACCI	66	MMS	—	7–12 $\pi^- p \rightarrow pMM$
1700 $\pm$ 15	^{13,14} FOCACCI	66	MMS	—	7–12 $\pi^- p \rightarrow pMM$
1748 $\pm$ 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

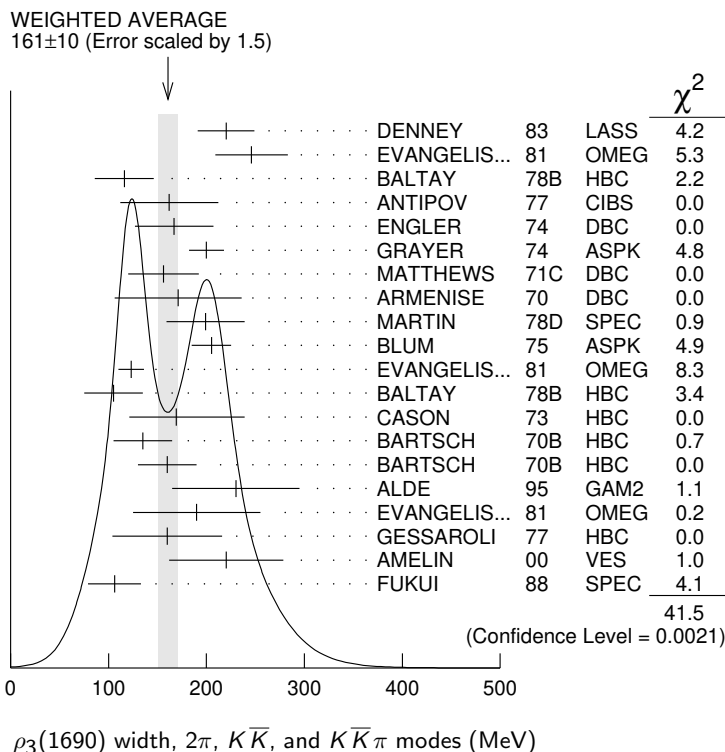
NODE=M015210

2 π , $K\bar{K}$, AND $K\bar{K}\pi$ MODES

VALUE (MeV)	DOCUMENT ID

161 $\pm$ 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

**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 $\pi^- p$

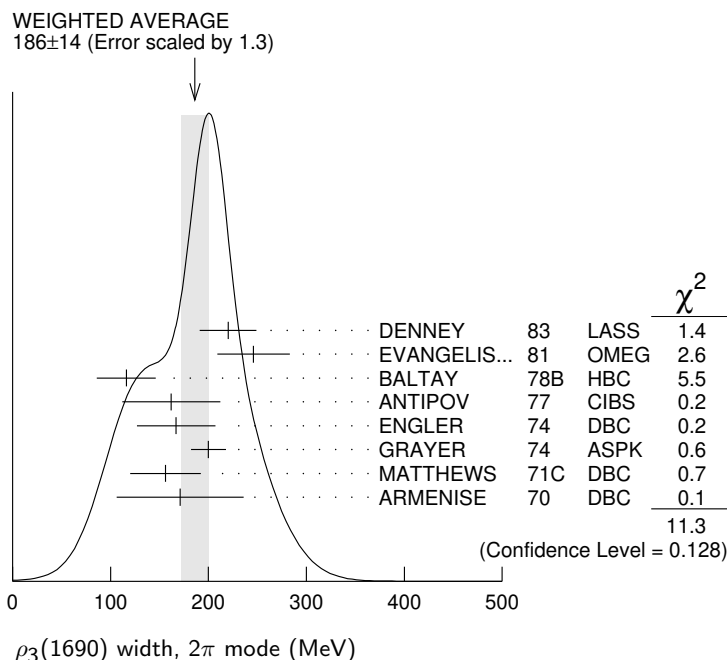
¹⁵ Width errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

¹⁶ Uses same data as HYAMS 75 and BECKER 79.

¹⁷ From a phase shift solution containing a $f_2'(1525)$ width two times larger than the $K\bar{K}$ result.

¹⁸ From 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.

NODE=M015W2
NODE=M015W2

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;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.

NODE=M015W3
NODE=M015W3

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 $\pi^+ p$

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=2

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.

NODE=M015W3;LINKAGE=A
NODE=M015W3;LINKAGE=B
NODE=M015W3;LINKAGE=C
NODE=M015W3;LINKAGE=F

$\omega\pi$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT

The data in this block is included in the average printed for a previous datablock.

190±40 OUR AVERAGE

230±65	²⁵ ALDE	95	GAM2	38 $\pi^- p \rightarrow \omega\pi^0 n$
190±65	EVANGELIS...	81	OMEG -	12 $\pi^- p \rightarrow \omega\pi p$
160±56	GESSAROLI	77	HBC	11 $\pi^- p \rightarrow \omega\pi p$

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

89±25	THOMPSON	74	HBC	+	13 $\pi^+ p$
130 ⁺⁷³ ₋₄₃	BARNHAM	70	HBC	+	10 $K^+ p \rightarrow \omega\pi X$

²⁵ Supersedes ALDE 92C.

 $\eta\pi^+\pi^-$ 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.

126±40 OUR AVERAGE Error includes scale factor of 1.8.

220±30±50	AMELIN	00	VES	37 $\pi^- p \rightarrow \eta\pi^+\pi^- n$
106±27	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. • • •

195	²⁶ ANDERSON	69	MMS	-	16 $\pi^- p$ backward
< 21	26,27 FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow pMM$
< 30	26,27 FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow pMM$
< 38	26,27 FOCACCI	66	MMS	-	7-12 $\pi^- p \rightarrow pMM$

²⁶ Seen in 2.5-3 GeV/c $\bar{p}p$. $2\pi^+2\pi^-$, with 0, 1, 2 $\pi^+\pi^-$ 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.

 $\rho_3(1690)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor
Γ_1 4π	(71.1 ± 1.9) %	
Γ_2 $\pi^\pm\pi^+\pi^-\pi^0$	(67 ± 22) %	
Γ_3 $\omega\pi$	(16 ± 6) %	
Γ_4 $\pi\pi$	(23.6 ± 1.3) %	
Γ_5 $K\bar{K}\pi$	(3.8 ± 1.2) %	
Γ_6 $K\bar{K}$	(1.58 ± 0.26) %	1.2
Γ_7 $\eta\pi^+\pi^-$	seen	
Γ_8 $\rho(770)\eta$	seen	
Γ_9 $\pi\pi\rho$	seen	
Γ_{10} $a_2(1320)\pi$	seen	
Γ_{11} $\rho\rho$	seen	
Γ_{12} $\phi\pi$		
Γ_{13} $\eta\pi$		
Γ_{14} $\pi^\pm 2\pi^+ 2\pi^- \pi^0$		

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 $\chi^2 = 14.7$ for 7 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_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

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

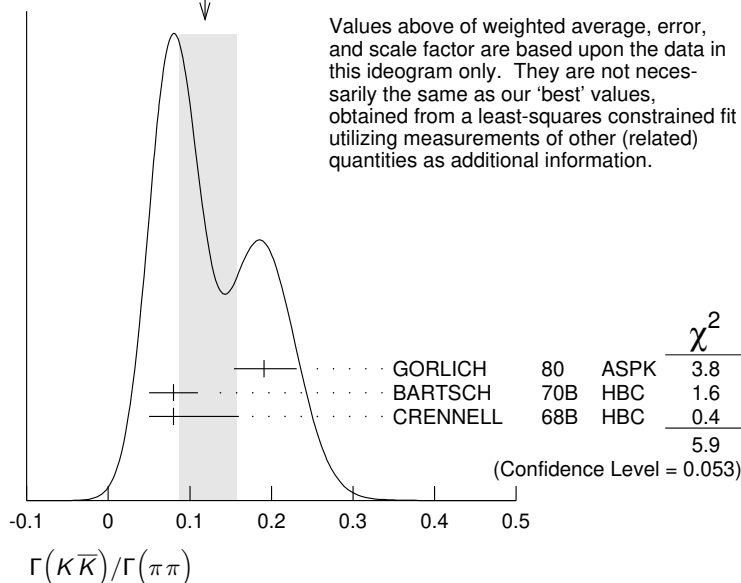
68B

HBC

6.0 $\pi^- p$

NODE=M015R4

NODE=M015R4

WEIGHTED AVERAGE
0.118+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				
0.013 ±0.003	COSTA	80	OMEG	0 10 $\pi^- p \rightarrow K^+ K^- n$
0.013 ±0.004	33 MARTIN	78B	SPEC	- 10 $\pi p \rightarrow K_S^0 K^- p$

NODE=M015R14
NODE=M015R14

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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NODE=M065

 $\rho(1700)$

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

NODE=M065

THE $\rho(1450)$ AND THE $\rho(1700)$

Updated September 2019 by S. Eidelman (Novosibirsk), C. Hanhart (Juelich) and G. Venanzoni (Pisa).

In our 1988 edition, we replaced the $\rho(1600)$ entry with two new ones, the $\rho(1450)$ and the $\rho(1700)$, because there was emerging evidence that the 1600-MeV region actually contains two ρ -like resonances. Erkal [1] had pointed out this possibility with a theoretical analysis on the consistency of 2π and 4π electromagnetic form factors and the $\pi\pi$ scattering length. Donnachie [2], with a full analysis of data on the 2π and 4π final states in e^+e^- annihilation and photoproduction reactions, had also argued that in order to obtain a consistent picture, two resonances were necessary. The existence of $\rho(1450)$ was supported by the analysis of $\eta\rho^0$ mass spectra obtained in photoproduction and e^+e^- annihilation [3], as well as that of $e^+e^- \rightarrow \omega\pi$ [4].

The analysis of [2] was further extended by [5,6] to include new data on 4π -systems produced in e^+e^- annihilation, and in τ -decays (τ decays to 4π , and e^+e^- annihilation to 4π can be related by the Conserved Vector Current assumption). These systems were successfully analyzed using interfering contributions from two ρ -like states, and from the tail of the $\rho(770)$ decaying into two-body states. While specific conclusions on $\rho(1450) \rightarrow 4\pi$ were obtained, little could be said about the $\rho(1700)$.

Independent evidence for two 1^- states is provided by [7] in 4π electroproduction at $\langle Q^2 \rangle = 1$ (GeV/c)², and by [8] in a high-statistics sample of the $\eta\pi\pi$ system in π^-p charge exchange.

This scenario with two overlapping resonances is supported by other data. Bisello [9] measured the pion form factor in the interval 1.35–2.4 GeV, and observed a deep minimum around 1.6 GeV. The best fit was obtained with the hypothesis of ρ -like resonances at 1420 and 1770 MeV, with widths of about 250 MeV. Antonelli [10] found that the $e^+e^- \rightarrow \eta\pi^+\pi^-$ cross section is better fitted with two fully interfering Breit-Wigners, with parameters in fair agreement with those of [2] and [9]. These results can be considered as a confirmation of the $\rho(1450)$.

Decisive evidence for the $\pi\pi$ decay mode of both $\rho(1450)$ and $\rho(1700)$ comes from $\bar{p}p$ annihilation at rest [11]. It

has been shown that these resonances also possess a $K\bar{K}$ decay mode [12–14]. . High-statistics studies of the decays $\tau \rightarrow \pi\pi\nu_\tau$ [15,16], and $\tau \rightarrow 4\pi\nu_\tau$ [17] also require the $\rho(1450)$, but are not sensitive to the $\rho(1700)$, because it is too close to the τ mass. A recent very-high-statistics study of the $\tau \rightarrow \pi\pi\nu_\tau$ decay performed at Belle [18] reports the first observation of both $\rho(1450)$ and $\rho(1700)$ in τ decays. A clear picture of the two $\pi^+\pi^-$ resonances interfering with the $\rho(770)$ in e^+e^- annihilation was also reported by BaBar using the ISR method [19].

The structure of these ρ states is not yet completely clear. Barnes [20] and Close [21] claim that $\rho(1450)$ has a mass consistent with radial $2S$, but its decays show characteristics of hybrids, and suggest that this state may be a $2S$ -hybrid mixture. Donnachie [22] argues that hybrid states could have a 4π decay mode dominated by the $a_1\pi$. Such behavior has been observed by [23] in $e^+e^- \rightarrow 4\pi$ in the energy range 1.05–1.38 GeV, and by [17] in $\tau \rightarrow 4\pi$ decays. CLEO [24] and Belle [25] observe the $\rho(1450) \rightarrow \omega\pi$ decay mode in B -meson decays, however, do not find $\rho(1700) \rightarrow \omega\pi^0$. A similar conclusion is made by [26,27], who studied the process $e^+e^- \rightarrow \omega\pi^0$ and do not observe a statistically significant signal of the $\rho(1700)$. Various decay modes of the $\rho(1450)$ and $\rho(1700)$ are observed in $\bar{p}n$ and $\bar{p}p$ annihilation [28,29], but no definite conclusions can be drawn. More data should be collected to clarify the nature of the ρ states, particularly in the energy range above 1.6 GeV.

We now list under a separate entry the $\rho(1570)$, the $\phi\pi$ state with $J^{PC} = 1^{--}$ earlier observed by [30] (referred to as $C(1480)$) and recently confirmed by [31]. While [32] shows that it may be a threshold effect, [5] and [33] suggest two independent vector states with this decay mode. The $C(1480)$ has not been seen in the $\bar{p}p$ [34] and e^+e^- [35,36] experiments. However, the sensitivity of the two latter is an order of magnitude lower than that of [31]. Note that [31] can not exclude that their observation is due to an OZI-suppressed decay mode of the $\rho(1700)$.

Several observations on the $\omega\pi$ system in the 1200-MeV region [37–43] may be interpreted in terms of either $J^P = 1^-$ $\rho(770) \rightarrow \omega\pi$ production [44], or $J^P = 1^+$ $b_1(1235)$ production [42,43]. We argue that no special entry for a $\rho(1250)$ is needed. The LASS amplitude analysis [45] showing evidence for $\rho(1270)$ is preliminary and needs confirmation.

For completeness, the relevant observations are listed under the $\rho(1450)$.

Recently [46] reported a very broad 1^{--} resonance-like K^+K^- state in $J/\psi \rightarrow K^+K^-\pi^0$ decays. Its pole position corresponds to mass of 1576 MeV and width of 818 MeV. [47–49] suggest its exotic structure (molecular or multiquark), while [50] and [51] explain it by the interference between the $\rho(1450)$ and $\rho(1700)$. The latter statement is qualitatively supported by BaBar [52] and SND [53]. We quote [46] as $X(1575)$ in the section “Further States.”

Evidence for ρ -like mesons decaying into 6π states was first noted by [54] in the analysis of 6π mass spectra from e^+e^- annihilation [55,56] and diffractive photoproduction [57]. Clegg [54] argued that two states at about 2.1 and 1.8 GeV exist: while the former is a candidate for the $\rho(2150)$, the latter could be a manifestation of the $\rho(1700)$ distorted by threshold effects. BaBar reported observations of the new decay modes of the $\rho(2150)$ in the channels $\eta'(958)\pi^+\pi^-$ and $f_1(1285)\pi^+\pi^-$ [58]. The relativistic quark model [59] predicts the 2^3D_1 state with $J^{PC} = 1^{--}$ at 2.15 GeV which can be identified with the $\rho(2150)$.

We no longer list under a separate particle $\rho(1900)$ various observations of irregular behavior of the cross sections near the $N\bar{N}$ threshold. Dips of various width around 1.9 GeV were reported by the E687 Collaboration (a narrow one in the $3\pi^+3\pi^-$ diffractive photoproduction [60,61]), by the FENICE experiment (a narrow structure in the R value [62]), by BaBar in ISR (a narrow structure in $e^+e^- \rightarrow \phi\pi$ final state [63], but much broader in $e^+e^- \rightarrow 3\pi^+3\pi^-$ and $e^+e^- \rightarrow 2(\pi^+\pi^-\pi^0)$ [64]), by CMD-3 (also a rather broad dip in $e^+e^- \rightarrow 3\pi^+3\pi^-$ [65]). A dedicated scan of the $N\bar{N}$ -threshold region by CMD-3 confirms this effect in the $e^+e^- \rightarrow 3\pi^+3\pi^-$ and $e^+e^- \rightarrow K^+K^-\pi^+\pi^-$ final states, but does not see it in the cross section of $e^+e^- \rightarrow 2\pi^+2\pi^-$ [66]. Most probably, these structures emerge as a threshold effect due to the opening of the $N\bar{N}$ channel [67,68,69].

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$\rho(1700)$ MASS

$\eta\rho^0$ AND $\pi^+\pi^-$ MODES

VALUE (MeV)

DOCUMENT ID

1720±20 OUR ESTIMATE

NODE=M065205

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NODE=M065M0

→ UNCHECKED ←

$\eta\rho^0$ MODE

VALUE (MeV)

EVTS

DOCUMENT ID

TECN

COMMENT

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NODE=M065M6

• • • 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	$^{+15}_{-20}$ 63.5k	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 5.4M	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	$17 \pi^- p$ 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	$17 \pi^- p \rightarrow \pi^+\pi^-n$

OCCUR=2

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.

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NODE=M065M1;LINKAGE=E

NODE=M065M1;LINKAGE=A

NODE=M065M1;LINKAGE=AB

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NODE=M065M1;LINKAGE=FU

NODE=M065M1;LINKAGE=GO

NODE=M065M;LINKAGE=QQ

NODE=M065M;LINKAGE=P

NODE=M065M;LINKAGE=M

NODE=M065M;LINKAGE=R

NODE=M065M;LINKAGE=H

NODE=M065M8

NODE=M065M8

 $\pi\omega$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

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

1708 ± 41	7815	1 ACHASOV	13	SND	$1.05-2.00 e^+e^- \rightarrow \pi^0\pi^0\gamma$
1550 to 1620		2 ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1580 to 1710		3 ACHASOV	00i	SND	$e^+e^- \rightarrow \pi^0\pi^0\gamma$
1710 ± 90		ACHASOV	97	RVUE	$e^+e^- \rightarrow \omega\pi^0$

OCCUR=2

¹ 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.

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 $\tau^- \rightarrow \omega\pi^-\nu_\tau$.

NODE=M065M8;LINKAGE=AC

NODE=M065M;LINKAGE=I1

NODE=M065M;LINKAGE=I2

$K\bar{K}$ MODE

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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

$1688.7 \pm 3.1^{+141.1}_{-1.3}$		¹ ALBRECHT	20	RVUE	$0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$
$1541 \pm 12 \pm 33$	190k	² AAIJ	16N	LHCB	$D^0 \rightarrow K_S^0 K^\pm \pi^\mp$
1740.8 ± 22.2	27k	³ ABELE	99D	CBAR $\pm$	$0.0 \bar{p} p \rightarrow K^+ K^- \pi^0$
1582 ± 36	1600	CLELAND	82B	SPEC $\pm$	$50 \pi p \rightarrow K_S^0 K^\pm p$

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 $\phi(1680)$.

NODE=M065M2
NODE=M065M2

NODE=M065M2;LINKAGE=D
NODE=M065M2;LINKAGE=A

NODE=M065M2;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. • • •

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	$20-70 \gamma p \rightarrow p 4\pi$
1654 ± 25		³ DIBIANCA	81	DBC	$\pi^+ d \rightarrow p p 2(\pi^+ \pi^-)$
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	$50 \gamma C \rightarrow C 4\pi^\pm$
1570 ± 60	65	⁵ ALEXANDER	75	HBC	$7.5 \gamma p \rightarrow p 4\pi$
1550 ± 60		² CONVERSI	74	OSPK	$e^+ e^- \rightarrow 2(\pi^+ \pi^-)$
1550 ± 50	160	SCHACHT	74	STRC	$5.5-9 \gamma p \rightarrow p 4\pi$
1450 ± 100	340	SCHACHT	74	STRC	$9-18 \gamma p \rightarrow p 4\pi$
1430 ± 50	400	BINGHAM	72B	HBC	$9.3 \gamma p \rightarrow p 4\pi$

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.

NODE=M065M4
NODE=M065M4

OCCUR=2

NODE=M065M;LINKAGE=A
NODE=M065M4;LINKAGE=M
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 $e^+ e^- \rightarrow 3(\pi^+ \pi^-) 2(\pi^+ \pi^- \pi^0)$

¹ From a fit with two resonances with the JACOB 72 continuum.

NODE=M065M7
NODE=M065M7

NODE=M065M;LINKAGE=PI

 $m_{\rho(1700)^0} - m_{\rho(1700)^\pm}$

NODE=M065DM

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 $e^+ e^- \rightarrow \pi^+ \pi^-, \tau^- \rightarrow \pi^- \pi^0 \nu_\tau$

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

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.

• • • 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.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=M065W6;LINKAGE=B

NODE=M065W6;LINKAGE=A

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.

• • • 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	$\begin{smallmatrix} +25 \\ -35 \end{smallmatrix}$	⁵ ABRAMOWICZ12	ZEUS		$ep \rightarrow e\pi^+\pi^-p$
316 ± 26		⁶ LEES	12G	BABR	$e^+e^- \rightarrow \pi^+\pi^-\gamma$
164 ± 21	$\begin{smallmatrix} +89 \\ -26 \end{smallmatrix}$	^{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	$e^+e^- \rightarrow \pi^+\pi^-$
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 $\begin{smallmatrix} +30 \\ -80 \end{smallmatrix}$		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 $\begin{smallmatrix} +98 \\ -53 \end{smallmatrix}$		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.

OCCUR=2

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

$K\bar{K}$ MODE

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT

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

$150.9 \pm 2.5^{+60}_{-10.6}$		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
NODE=M065W2

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	⁵ 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	⁶ SCHACHT	74	STRC	$5.5-9 \gamma p \rightarrow p4\pi$
850 ± 200	340	⁶ 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
NODE=M065W;LINKAGE=D
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

 $\omega\pi^0$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

350 to 580	¹ ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$
490 to 1040	² ACHASOV	00I	SND $e^+e^- \rightarrow \pi^0\pi^0\gamma$

¹ 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.

² 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 $\tau^- \rightarrow \omega\pi^- \nu_\tau$.

NODE=M065W9
NODE=M065W9

OCCUR=2

NODE=M065W;LINKAGE=I1

NODE=M065W;LINKAGE=I2

 $3(\pi^+\pi^-)$ 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.

NODE=M065W7
NODE=M065W7

NODE=M065W;LINKAGE=PI

$$\Gamma_{\rho(1700)^0} - \Gamma_{\rho(1700)^\pm}$$

NODE=M065DW

NODE=M065DW

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.

NODE=M065DW;LINKAGE=A

$\rho(1700)$ DECAY MODES

NODE=M065215;NODE=M065

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} $K\bar{K}^*(892)+\text{c.c.}$	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

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

 $\rho(1700) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M065225

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.

NODE=M065225

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_{17}/\Gamma$
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=M065G2
NODE=M065G2

$\Gamma(\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{11}\Gamma_{17}/\Gamma$
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 $e^+e^- \rightarrow \pi^+\pi^-$

NODE=M065G4
NODE=M065G4¹ Using total width = 220 MeV.

NODE=M065G4;LINKAGE=B

$\Gamma(K\bar{K}^*(892)+\text{c.c.}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_{13}\Gamma_{17}/\Gamma$
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^-

NODE=M065G10
NODE=M065G10¹ Model dependent.

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 $e^+e^- \rightarrow \eta\pi^+\pi^-$

NODE=M065G11
NODE=M065G11¹ 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=M065G11;LINKAGE=B

² Includes non-resonant contribution. The selected fit model includes three ρ excited states. Model uncertainty is 80%.

NODE=M065G11;LINKAGE=A

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

VALUE (keV) DOCUMENT ID TECN COMMENT

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

0.035±0.029 ¹ BIZOT 80 DM1 e⁺e⁻

¹ Model dependent.

$$\Gamma_{16}\Gamma_{17}/\Gamma$$

NODE=M065G5
NODE=M065G5

NODE=M065G5;LINKAGE=M

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

VALUE (keV) DOCUMENT ID TECN COMMENT

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

3.510±0.090 ¹ BIZOT 80 DM1 e⁺e⁻

¹ Model dependent.

$$\Gamma_3\Gamma_{17}/\Gamma$$

NODE=M065G12
NODE=M065G12

NODE=M065G12;LINKAGE=M

$$\rho(1700) \Gamma(i)/\Gamma(\text{total}) \times \Gamma(e^+e^-)/\Gamma(\text{total})$$

NODE=M065240

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

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⁻ → π⁰π⁰γ
1.7 ±0.4 7815 ² ACHASOV 13 SND 1.05–2.00 e⁺e⁻ → π⁰π⁰γ

¹ From a phenomenological model based on vector meson dominance with interfering ρ(700), ρ(1450), and ρ(1700). The ρ(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 ρ(1450) and ρ(1700) and their widths fixed at 400 and 250 MeV, respectively. Systematic uncertainty not estimated.

$$\Gamma_{18}/\Gamma \times \Gamma_{17}/\Gamma$$

NODE=M065R01
NODE=M065R01

OCCUR=4

NODE=M065R01;LINKAGE=B

NODE=M065R01;LINKAGE=AC

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

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⁻ → ηπ⁺π⁻

¹ From the combined fit of AULCHENKO 15 and ACHASOV 18 in the model with the interfering ρ(1450), ρ(1700) and ρ(2150) with the parameters of the ρ(1450) and ρ(1700) floating and the mass and width of the ρ(2150) fixed at 2155 MeV and 320 MeV, respectively. The phases of the resonances are π, 0 and π, respectively.

$$\Gamma_{14}/\Gamma \times \Gamma_{17}/\Gamma$$

NODE=M065R00
NODE=M065R00

NODE=M065R00;LINKAGE=A

ρ(1700) BRANCHING RATIOS

NODE=M065230

$$\Gamma(\rho\pi\pi)/\Gamma(4\pi)$$

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 ωπ not included.

$$\Gamma_3/\Gamma_1$$

NODE=M065R19
NODE=M065R19

NODE=M065R;LINKAGE=BL

$$\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$$

VALUE EVTS DOCUMENT ID TECN COMMENT

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

~ 1.0 DELCOURT 81B DM1 e⁺e⁻ → 2(π⁺π⁻)
0.7 ±0.1 500 SCHACHT 74 STRC 5.5–18 γp → p4π
0.80 ¹ BINGHAM 72B HBC 9.3 γp → p4π

¹ The ππ system is in S-wave.

$$\Gamma_4/\Gamma_2$$

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 γp
<0.15 ATKINSON 82 OMEG 0 20–70 γp → p4π

$$\Gamma_5/\Gamma_6$$

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 ωπ not included.

$$\Gamma_7/\Gamma_1$$

NODE=M065R15
NODE=M065R15

NODE=M065R15;LINKAGE=BL

$\Gamma(h_1(1170)\pi)/\Gamma(4\pi)$ Γ_8/Γ_1

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.			

NODE=M065R16
 NODE=M065R16

NODE=M065R16;LINKAGE=BL

 $\Gamma(\pi(1300)\pi)/\Gamma(4\pi)$ Γ_9/Γ_1

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.			

NODE=M065R17
 NODE=M065R17

NODE=M065R17;LINKAGE=BL

 $\Gamma(\rho\rho)/\Gamma(4\pi)$ Γ_{10}/Γ_1

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.			

NODE=M065R18
 NODE=M065R18

NODE=M065R18;LINKAGE=BL

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

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 $17 \pi^- p \rightarrow \pi^+ \pi^- n$

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

 $\Gamma(K\bar{K})/\Gamma_{\text{total}}$ Γ_{16}/Γ

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 $0.9 \bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M065R03
 NODE=M065R03

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.

NODE=M065R03;LINKAGE=A

 $\Gamma(\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))$ Γ_{11}/Γ_2

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 $9.3 \gamma p \rightarrow p 2\pi$

NODE=M065R3
 NODE=M065R3

¹ Upper limit is estimate.

² 2σ upper limit.

NODE=M065R3;LINKAGE=E
 NODE=M065R3;LINKAGE=S

 $\Gamma(\pi\pi)/\Gamma(4\pi)$ Γ_{12}/Γ_1

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 $0.0 \bar{p} n \rightarrow 5\pi$

NODE=M065R20
 NODE=M065R20

¹ Using ABELE 97.

² $\omega\pi$ not included.

NODE=M065R;LINKAGE=LK
 NODE=M065R20;LINKAGE=BL

 $\Gamma(K\bar{K}^*(892)+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/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=M065R21
 NODE=M065R21

$\Gamma(K\bar{K}^*(892)+c.c.)/\Gamma(2(\pi^+\pi^-))$ Γ_{13}/Γ_2

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.

NODE=M065R9
NODE=M065R9

NODE=M065R9;LINKAGE=D

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ Γ_{14}/Γ

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 γp

NODE=M065R12
NODE=M065R12

 $\Gamma(\eta\rho)/\Gamma(2(\pi^+\pi^-))$ Γ_{14}/Γ_2

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 γp

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 γp ¹ Upper limit. Background not subtracted.

NODE=M065R7
NODE=M065R7

NODE=M065R7;LINKAGE=U

 $\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$ Γ_{15}/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=M065R14
NODE=M065R14

 $\Gamma(K\bar{K})/\Gamma(2(\pi^+\pi^-))$ Γ_{16}/Γ_2

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 9.3 γp ¹ Assuming $\rho(1700)$ and ω radial excitations to be degenerate in mass.

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

$\rho(1700)$ REFERENCES

NODE=M065

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
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	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
AMBROSINO	11A	PL B700 102	F. Ambrosino <i>et al.</i>	(KLOE Collab.)	REFID=16683
GARCIA-MAR...	11A	PR D83 074004	R. Garcia-Martin <i>et al.</i>	(MADR, CRAC)	REFID=54121
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
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	JETPL 103 380	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=51113
		Translated from ZETFP 130 437.			
COAN	04	PRL 92 232001	T.E. Coan <i>et al.</i>	(CLEO Collab.)	REFID=49945
FRABETTI	04	PL B578 290	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)	REFID=49614
AKHMETSHIN	03B	PL B562 173	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=49406
ABELE	01B	EPJ C21 261	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=48356
ACHASOV	00I	PL B486 29	M.N. Achasov <i>et al.</i>	(Novosibirsk SND Collab.)	REFID=47931
AKHMETSHIN	00D	PL B489 125	R.R. Akhmetshin <i>et al.</i>	(Novosibirsk CMD-2 Collab.)	REFID=47935
AMELIN	00	NP A668 83	D. Amelin <i>et al.</i>	(VES Collab.)	REFID=47432
EDWARDS	00A	PR D61 072003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=47465
ABELE	99D	PL B468 178	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=47401
ABELE	97	PL B391 191	A. Abele <i>et al.</i>	(Crystal Barrel Collab.)	REFID=45415
ACHASOV	97	PR D55 2663	N.N. Achasov <i>et al.</i>	(NOVM)	REFID=45382
BERTIN	97C	PL B408 476	A. Bertin <i>et al.</i>	(OBELIX Collab.)	REFID=45701
CLEGG	94	ZPHY C62 455	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=44081
CLEGG	90	ZPHY C45 677	A.B. Clegg, A. Donnachie	(LANC, MCHS)	REFID=41355
KUHN	90	ZPHY C48 445	J.H. Kuhn <i>et al.</i>	(MPIM)	REFID=45862
BISELLO	89	PL B220 321	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=40740
DUBNICKA	89	JP G15 1349	S. Dubnicka <i>et al.</i>	(JINR, SLOV)	REFID=44082
GESHKEN...	89	ZPHY C45 351	B.V. Geshkenbein	(ITEP)	REFID=41017
ANTONELLI	88	PL B212 133	A. Antonelli <i>et al.</i>	(DM2 Collab.)	REFID=40583
DIEKMANN	88	PRPL 159 99	B. Diekmann	(BONN)	REFID=40272
FUKUI	88	PL B202 441	S. Fukui <i>et al.</i>	(SUGI, NAGO, KEK, KYOT+)	REFID=40273
DONNACHIE	87B	ZPHY C34 257	A. Donnachie, A.B. Clegg	(MCHS, LANC)	REFID=40920
ATKINSON	86B	ZPHY C30 531	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21508
ATKINSON	85B	ZPHY C26 499	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21506
ERKAL	85	ZPHY C29 485	C. Erkal, M.G. Olsson	(WISC)	REFID=20136
ABE	84B	PRL 53 751	K. Abe <i>et al.</i>	(SLAC HFP Collab.)	REFID=21503
KURDADZE	83	JETPL 37 733	L.M. Kurdadze <i>et al.</i>	(NOVO)	REFID=20133
		Translated from ZETFP 37 613.			
ATKINSON	82	PL 108B 55	M. Atkinson <i>et al.</i>	(BONN, CERN, GLAS+)	REFID=21493
BUON	82	PL 118B 221	J. Buon <i>et al.</i>	(LALO, MONP)	REFID=21494
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)	REFID=21281
CORDIER	82	PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DELCOURT	82	PL 113B 93	B. Delcourt <i>et al.</i>	(LALO)	REFID=21496
ASTON	81E	NP B189 15	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21487
DELCOURT	81B	Bonn Conf. 205	B. Delcourt	(ORSAY)	REFID=21490
Also		PL 109B 129	A. Cordier <i>et al.</i>	(LALO)	REFID=21495
DIBIANCA	81	PR D23 595	F.A. di Bianca <i>et al.</i>	(CASE, CMU)	REFID=21492
ASTON	80	PL 92B 215	D. Aston	(BONN, CERN, EPOL, GLAS, LANC+)	REFID=21478
BACCI	80	PL 95B 139	C. Bacci <i>et al.</i>	(ROMA, FRAS)	REFID=21481
BIZOT	80	Madison Conf. 546	J.C. Bizot <i>et al.</i>	(LALO, MONP)	REFID=21482
KILLIAN	80	PR D21 3005	T.J. Killian <i>et al.</i>	(CORN)	REFID=21484
ATIYA	79B	PRL 43 1691	M.S. Atiya <i>et al.</i>	(COLU, ILL, FNAL)	REFID=21470
BECKER	79	NP B151 46	H. Becker <i>et al.</i>	(MPIM, CERN, ZEEM, CRAC)	REFID=21084
LANG	79	PR D19 956	C.B. Lang, A. Mas-Parareda	(GRAZ)	REFID=20126
MARTIN	78C	ANP 114 1	A.D. Martin, M.R. Pennington	(CERN)	REFID=21661
COSTA...	77B	PL 71B 345	B. Costa de Beauregard, B. Pire, T.N. Truong	(EPOL)	REFID=21465
FROGGATT	77	NP B129 89	C.D. Froggatt, J.L. Petersen	(GLAS, NORD)	REFID=21072
ALEXANDER	75	PL 57B 487	G. Alexander <i>et al.</i>	(TELA)	REFID=21450
HYAMS	75	NP B100 205	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20355
BALLAM	74	NP B76 375	J. Ballam <i>et al.</i>	(SLAC, LBL, MPIM)	REFID=20610
CONVERSI	74	PL 52B 493	M. Conversi <i>et al.</i>	(ROMA, FRAS)	REFID=20637
SCHACHT	74	NP B81 205	P. Schacht <i>et al.</i>	(MPIM)	REFID=21449
DAVIER	73	NP B58 31	M. Davier <i>et al.</i>	(SLAC)	REFID=21434
EISENBERG	73	PL 43B 149	Y. Eisenberg <i>et al.</i>	(REHO)	REFID=21435
HYAMS	73	NP B64 134	B.D. Hyams <i>et al.</i>	(CERN, MPIM)	REFID=20107
BINGHAM	72B	PL 41B 635	H.H. Bingham <i>et al.</i>	(LBL, UCB, SLAC) IGJP	REFID=21426
JACOB	72	PR D5 1847	M. Jacob, R. Slansky		REFID=49668
GOUNARIS	68	PRL 21 244	G.J. Gounaris, J.J. Sakurai		REFID=48054

$a_2(1700)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

NODE=M162

 $a_2(1700)$ MASS

NODE=M162M

NODE=M162M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1705 ±40 OUR AVERAGE				
1722 ±15 ±67		¹ RODAS 19	JPAC	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
1698 ±44		² AMSLER 02	CBAR	0.9 $\bar{p} p \rightarrow \pi^0 \eta \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1638.9 ± 2.3 ^{+57.4} _{-0.1}		³ ALBRECHT 20	RVUE	0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
1681 ⁺²² ₋₃₅	46M	^{4,5} AGHASYAN 18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1720 ±10 ±60		⁶ JACKURA 18	JPAC	$\pi^- p \rightarrow \eta \pi^- p$
1726 ±12 ±25		⁵ ABLIKIM 17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
1675 ±25		ANISOVICH 09	RVUE	0.0 $\bar{p} p, \pi N$
1722 ± 9 ±15	18k	⁷ SCHEGELSKY 06	RVUE	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$
1702 ± 7	80k	⁸ UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
1721 ±13 ±44	145k	LU 05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
1737 ± 5 ± 7		ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
1767 ±14	221	⁹ ACCIARRI 01H	L3	$\gamma \gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
1660 ±40		⁵ ABELE 99B	CBAR	1.94 $\bar{p} p \rightarrow \pi^0 \eta \eta$
~ 1775		¹⁰ GRYGOREV 99	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1752 ±21 ± 4		ACCIARRI 97T	L3	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$

¹ The coupled-channel analysis of both the $\eta \pi$ and $\eta' \pi$ systems using ADOLPH 15data. The mass is extracted from the T-matrix pole.

² T-matrix pole.

³ T-matrix pole, 2 poles, 2 channels ($\pi \eta, K \bar{K}$).

⁴ Statistical error negligible.

⁵ Breit-Wigner mass.

⁶ Superseded by RODAS 19.

⁷ From analysis of L3 data at 183–209 GeV.

⁸ Statistical error only.

⁹ Spin 2 dominant, isospin not determined, could also be $I=1$.

¹⁰ Possibly two $J^P = 2^+$ resonances with isospins 0 and 1.

NODE=M162M;LINKAGE=C

NODE=M162M;LINKAGE=TT

NODE=M162M;LINKAGE=G

NODE=M162M;LINKAGE=B

NODE=M162M;LINKAGE=E

NODE=M162M;LINKAGE=D

NODE=M162M;LINKAGE=SC

NODE=M162M;LINKAGE=ST

NODE=M162M;LINKAGE=HA

NODE=M162M;LINKAGE=GR

 $a_2(1700)$ WIDTH

NODE=M162W

NODE=M162W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
258 ± 40 OUR AVERAGE				
247 ± 17 ±63		¹ RODAS 19	JPAC	191 $\pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
265 ± 55		² AMSLER 02	CBAR	0.9 $\bar{p} p \rightarrow \pi^0 \eta \eta$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
224.0 ± 2.5 ^{+1.8} _{-48.3}		³ ALBRECHT 20	RVUE	0.9 $\bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta, \pi^0 K^+ K^-$
436 ⁺²⁰ ₋₁₆	46M	^{4,5} AGHASYAN 18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
280 ± 10 ±70		⁶ JACKURA 18	JPAC	$\pi^- p \rightarrow \eta \pi^- p$
190 ± 18 ±30		⁵ ABLIKIM 17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
270 ⁺⁵⁰ ₋₂₀		ANISOVICH 09	RVUE	0.0 $\bar{p} p, \pi N$
336 ± 20 ±20	18k	⁷ SCHEGELSKY 06	RVUE	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$
417 ± 19	80k	⁸ UMAN 06	E835	5.2 $\bar{p} p \rightarrow \eta \eta \pi^0$
279 ± 49 ±66	145k	LU 05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
151 ± 22 ±24		ABE 04	BELL	10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$
187 ± 60	221	⁹ ACCIARRI 01H	L3	$\gamma \gamma \rightarrow K_S^0 K_S^0, E_{cm}^{ee} = 91, 183-209 \text{ GeV}$
280 ± 70		⁵ ABELE 99B	CBAR	1.94 $\bar{p} p \rightarrow \pi^0 \eta \eta$
150 ±110 ±34		ACCIARRI 97T	L3	$\gamma \gamma \rightarrow \pi^+ \pi^- \pi^0$

- ¹ The coupled-channel analysis of both the $\eta\pi$ and $\eta'\pi$ systems using ADOLPH 15data. The width is extracted from the T-matrix pole.
² T-matrix pole.
³ T-matrix pole, 2 poles, 2 channels ($\pi\eta$, $K\bar{K}$).
⁴ Statistical error negligible.
⁵ Breit-Wigner width.
⁶ Superseded by RODAS 19.
⁷ From analysis of L3 data at 183–209 GeV.
⁸ Statistical error only.
⁹ Spin 2 dominant, isospin not determined, could also be $I=1$.

NODE=M162W;LINKAGE=C

NODE=M162W;LINKAGE=TT
 NODE=M162W;LINKAGE=G
 NODE=M162W;LINKAGE=B
 NODE=M162W;LINKAGE=E
 NODE=M162W;LINKAGE=D
 NODE=M162W;LINKAGE=SC
 NODE=M162W;LINKAGE=ST
 NODE=M162W;LINKAGE=HA

NODE=M162215;NODE=M162

 $a_2(1700)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\eta\pi$	$(3.7 \pm 1.0) \%$
Γ_2 $\gamma\gamma$	$(1.16 \pm 0.27) \times 10^{-6}$
Γ_3 $\rho\pi$	seen
Γ_4 $f_2(1270)\pi$	seen
Γ_5 $K\bar{K}$	$(1.9 \pm 1.2) \%$
Γ_6 $\omega\pi^-\pi^0$	seen
Γ_7 $\omega\rho$	seen

DESIG=4

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

$\Gamma(\eta\pi)$					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=M162220

NODE=M162W3
 NODE=M162W3

$\Gamma(\gamma\gamma)$					Γ_2
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
0.30 ± 0.05	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M162W2
 NODE=M162W2

$\Gamma(K\bar{K})$					Γ_5
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
5.0 ± 3.0	870	¹ SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M162W1
 NODE=M162W1

$\Gamma(K\bar{K})/\Gamma(\eta\pi)$					Γ_5/Γ_1
VALUE		DOCUMENT ID	TECN	COMMENT	

NODE=M162R00
 NODE=M162R00

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

$4.134 \pm 0.106^{+4.909}_{-2.988}$ ² ALBRECHT 20 RVUE $0.9 \bar{p}p \rightarrow \pi^0 \pi^0 \eta$,
 $\pi^0 \eta \eta$, $\pi^0 K^+ K^-$

ERROR=9

² Residues from T-matrix pole, 2 poles, 2 channels ($\pi\eta$, $K\bar{K}$).

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=M162R00;LINKAGE=A
 NODE=M162W1;LINKAGE=SC

 $a_2(1700)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$[\Gamma(\rho\pi) + \Gamma(f_2(1270)\pi)] \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$(\Gamma_3 + \Gamma_4)\Gamma_2/\Gamma$
VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.29 \pm 0.04 \pm 0.02$		ACCIARRI 97T	L3	$\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$	

NODE=M162G1
 NODE=M162G1

• • • 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 $\gamma\gamma \rightarrow \pi^+ \pi^- \pi^0$

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_2/\Gamma$
VALUE (eV)		DOCUMENT ID	TECN	COMMENT	

NODE=M162G2
 NODE=M162G2

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

$20.6 \pm 4.2 \pm 4.6$ ² ABE 04 BELL $10.6 e^+ e^- \rightarrow e^+ e^- K^+ K^-$
 $49 \pm 11 \pm 13$ ³ ACCIARRI 01H L3 $\gamma\gamma \rightarrow K_S^0 K_S^0$, $E_{\text{cm}}^{\text{ee}} = 91$,
 183–209 GeV

NODE=M162G1;LINKAGE=SC
 NODE=M162G2;LINKAGE=AB
 NODE=M162G;LINKAGE=HA

¹ From analysis of L3 data at 183–209 GeV.

² Assuming spin 2.

³ Spin 2 dominant, isospin not determined, could also be $I=1$.

$a_2(1700)$ BRANCHING RATIOS **$\Gamma(\rho\pi)/\Gamma(f_2(1270)\pi)$** **$\Gamma_3/\Gamma_4$**

VALUE	EVS	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	$\gamma\gamma \rightarrow \pi^+\pi^-\pi^0$

¹ From analysis of L3 data at 183–209 GeV.

NODE=M162235

NODE=M162R01
NODE=M162R01

NODE=M162R01;LINKAGE=SC

 $a_2(1700)$ REFERENCES

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	
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. Amisler <i>et al.</i>	
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.)

NODE=M162

REFID=60439
REFID=59554
REFID=59471
REFID=59003
REFID=57953
REFID=56385
REFID=52719
REFID=51186
REFID=51185
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REFID=50459
REFID=49650
REFID=48580
REFID=48321
REFID=46904
REFID=46909

REFID=45761

NODE=M068

 $f_0(1710)$

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

See the review on "Non- $q\bar{q}$ Mesons."

NODE=M068

 $f_0(1710)$ MASS

OUR EVALUATION below is based on T-matrix poles from BARBERIS 00E and BARBERIS 99D.

NODE=M068M

NODE=M068M

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT

 1704 ± 12 OUR EVALUATION **1732^{+9}_{-7} OUR AVERAGE** Error includes scale factor of 1.6. See the ideogram below.

1759 ± 6	$^{+14}_{-25}$	5.5k	¹ ABLIKIM	13N	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
1750^{+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^{+4}_{-3}	± 13		⁴ 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^{+30}_{-25}			BAI	00A	BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
1710 ± 25			⁵ FRENCH	99		$300 p p \rightarrow p_f(K^+ K^-) p_s$

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

1803 ± 3.5	$^{+45.5}_{-10.4}$		⁶ ALBRECHT	20	RVUE	$0.9 \bar{p} p \rightarrow \pi^0 \pi^0 \eta, \pi^0 \eta \eta,$ $\pi^0 K^+ K^-$
1744 ± 7	± 5	381	^{7,8} DOBBS	15		$J/\psi \rightarrow \gamma\pi^+\pi^-$
1705 ± 11	± 5	237	^{7,8} DOBBS	15		$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
1706 ± 4	± 5	1.0k	^{7,8} DOBBS	15		$J/\psi \rightarrow \gamma K^+ K^-$
1690 ± 8	± 3	349	^{7,8} 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	^{4,9} UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$
1776 ± 15			VLADIMIRSK...	06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
1790^{+40}_{-30}			¹⁰ ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
1760 ± 15	$^{+15}_{-10}$		¹⁰ ABLIKIM	05Q	BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^- K^+ K^-$
1670 ± 20			⁴ BINON	05	GAMS	$33 \pi^- p \rightarrow \eta \eta n$
1732 ± 15			¹¹ ANISOVICH	03	RVUE	
1682 ± 16			TIKHOMIROV	03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_S^0 X$
1670 ± 26		3.6k	¹² NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M068M

→ UNCHECKED ←

OCCUR=3

OCCUR=2
OCCUR=3
OCCUR=4

1698±18		13 BARBERIS	00E	450 $pp \rightarrow pf\eta\eta p_S$	
1770±12		14 ANISOVICH	99B SPEC	0.6–1.2 $p\bar{p} \rightarrow \eta\eta\pi^0$	
1730±15		BARBERIS	99 OMEG	450 $pp \rightarrow p_S p_f K^+ K^-$	
1750±20		BARBERIS	99B OMEG	450 $pp \rightarrow p_S p_f \pi^+ \pi^-$	
1710±12 ±11		15 BARBERIS	99D OMEG	450 $pp \rightarrow K^+ K^-, \pi^+ \pi^-$	
1750±30		16 ANISOVICH	98B RVUE	Compilation	
1720±39		BAI	98H BES	$J/\psi \rightarrow \gamma\pi^0\pi^0$	
1775±1.5	57	17 BARKOV	98	$\pi^- p \rightarrow K_S^0 K_S^0 n$	
1690±11		18 ABREU	96C DLPH	$Z^0 \rightarrow K^+ K^- + X$	
1696±5 + ₋₃₄ ⁹		19 BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$	
1781±8 + ₋₃₁ ¹⁰		BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$	OCCUR=2
1768±14		BALOSHIN	95 SPEC	40 $\pi^- C \rightarrow K_S^0 K_S^0 X$	
1750±15		20 BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	
1620±16		19 BUGG	95 MRK3	$J/\psi \rightarrow \gamma\pi^+\pi^-\pi^+\pi^-$	OCCUR=2
1748±10		21 ARMSTRONG	93C E760	$\bar{p}p \rightarrow \pi^0\eta\eta \rightarrow 6\gamma$	
~1750		BREAKSTONE	93 SFM	$pp \rightarrow pp\pi^+\pi^-\pi^+\pi^-$	
1744±15		22 ALDE	92D GAM2	38 $\pi^- p \rightarrow \eta\eta n$	
1713±10		23 ARMSTRONG	89D OMEG	300 $pp \rightarrow ppK^+ K^-$	
1706±10		23 ARMSTRONG	89D OMEG	300 $pp \rightarrow ppK_S^0 K_S^0$	OCCUR=2
1707±10		21 AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$	
1700±15		19 BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	
1720±60		BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	OCCUR=2
1638±10		24 FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
1690±4		25 FALVARD	88 DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
1698±15		21 AUGUSTIN	87 DM2	$J/\psi \rightarrow \gamma\pi^+\pi^-$	
1720±10 ±10		19 BALTRUSAIT..	87 MRK3	$J/\psi \rightarrow \gamma K^+ K^-$	
1755±8		26 ALDE	86C GAM2	38 $\pi^- p \rightarrow n2\eta$	
1730 ⁺ ₋₁₀ ²		27 LONGACRE	86 RVUE	22 $\pi^- p \rightarrow n2K_S^0$	
1742±15		21 WILLIAMS	84 MPSF	200 $\pi^- N \rightarrow 2K_S^0 X$	
1670±50		BLOOM	83 CBAL	$J/\psi \rightarrow \gamma2\eta$	
1650±50		BURKE	82 MRK2	$J/\psi \rightarrow \gamma2\rho$	
1640±50	28,29	EDWARDS	82D CBAL	$J/\psi \rightarrow \gamma2\eta$	
1730±10 ±20		30 ETKIN	82C MPS	23 $\pi^- p \rightarrow n2K_S^0$	

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 Breit-Wigner mass.

⁵ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

⁶ 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 ($\eta\eta'$).

⁷ Using CLEO-c data but not authored by the CLEO Collaboration.

⁸ From a fit to a Breit-Wigner line shape with fixed $\Gamma = 135$ MeV.

⁹ Systematic errors not estimated.

¹⁰ This state may be different from $f_0(1710)$, see CLOSE 05.

¹¹ K-matrix pole, assuming $J^P = 0^+$, 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.

¹² Decaying to $f_0(1370)\pi\pi$.

¹³ T-matrix pole.

¹⁴ Not seen by AMSLER 02.

¹⁵ Supersedes BARBERIS 99 and BARBERIS 99B.

¹⁶ T-matrix pole, assuming $J^P = 0^+$

¹⁷ No J^{PC} determination.

¹⁸ No J^{PC} determination, width not determined.

¹⁹ $J^P = 2^+$.

²⁰ From a fit to the 0^+ partial wave.

²¹ No J^{PC} determination.

²² ALDE 92D combines all the GAMS-2000 data.

²³ $J^P = 2^+$, superseded by FRENCH 99.

²⁴ From an analysis ignoring interference with $f_2'(1525)$.

²⁵ From an analysis including interference with $f_2'(1525)$.

NODE=M068M;LINKAGE=D

NODE=M068M;LINKAGE=H

NODE=M068M;LINKAGE=HE

NODE=M068M;LINKAGE=BW

NODE=M068M;LINKAGE=C3

NODE=M068M;LINKAGE=TP

NODE=M068M;LINKAGE=F

NODE=M068M;LINKAGE=G

NODE=M068M;LINKAGE=CH

NODE=M068M;LINKAGE=AB

NODE=M068M;LINKAGE=KM

NODE=M068M;LINKAGE=NC

NODE=M068M;LINKAGE=J

NODE=M068M;LINKAGE=NS

NODE=M068M;LINKAGE=BD

NODE=M068M;LINKAGE=AN

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

²⁶ Superseded by ALDE 92D.

²⁷ 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.

²⁸ $J^P = 2^+$ preferred.

²⁹ From fit neglecting nearby $f'_2(1525)$. Replaced by BLOOM 83.

³⁰ Superseded by LONGACRE 86.

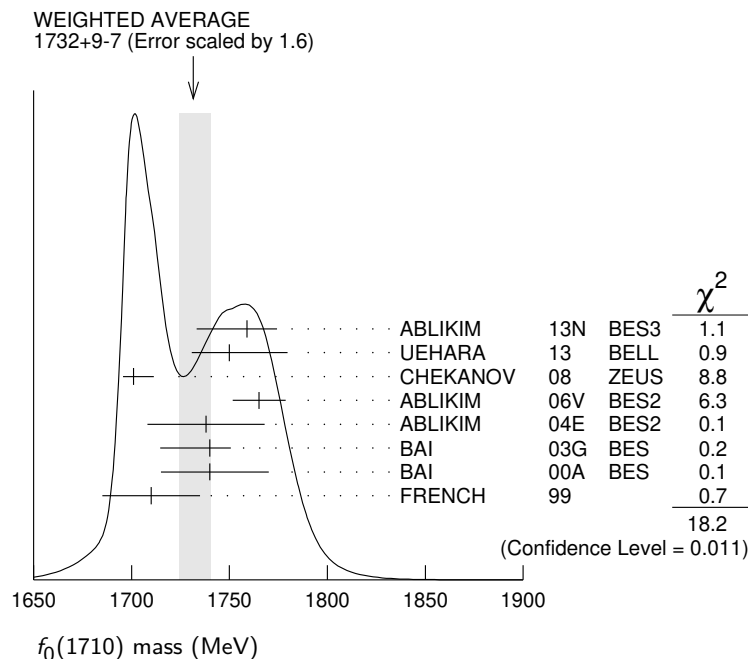
NODE=M068M;LINKAGE=BB

NODE=M068M;LINKAGE=A9

NODE=M068M;LINKAGE=B2

NODE=M068M;LINKAGE=E

NODE=M068M;LINKAGE=B1



$f_0(1710)$ WIDTH

OUR EVALUATION below is based on T-matrix poles from BARBERIS 00E and BARBERIS 99D.

NODE=M068W

NODE=M068W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
123 ± 18	OUR EVALUATION			
147 ± 12	OUR AVERAGE	Error includes scale factor of 1.2.		
172 ± 10	$^{+32}_{-16}$ 5.5k	¹ ABLIKIM	13N BES3	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\eta\eta$
139 ± 11	$^{+96}_{-50}$	² UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
100 ± 24	$^{+7}_{-22}$ 4k	³ CHEKANOV	08 ZEUS	$ep \rightarrow K_S^0 K_S^0 X$
145 ± 8	± 69	⁴ ABLIKIM	06V BES2	$e^+e^- \rightarrow J/\psi \rightarrow \gamma\pi^+\pi^-$
125 ± 20		ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
166 ± 5	$^{+15}_{-10}$	BAI	03G BES	$J/\psi \rightarrow \gamma K \bar{K}$
120 ± 50		BAI	00A BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
105 ± 34		⁵ FRENCH	99	300 $pp \rightarrow p_f(K^+K^-)p_s$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
289.7 ± 5.0	$^{+32.6}_{-19.3}$	⁶ ALBRECHT	20 RVUE	$0.9 \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0 K^+ K^-$
148 ± 40	$^{+40}_{-30}$	AMSLER	06 CBAR	$1.64 \bar{p}p \rightarrow K^+ K^- \pi^0$
188 ± 13	80k	^{4,7} UMAN	06 E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
250 ± 30		VLADIMIRSK...	06 SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
270 ± 60	$^{+60}_{-30}$	⁸ ABLIKIM	05 BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
125 ± 25	$^{+10}_{-15}$	⁴ ABLIKIM	05Q BES2	$\psi(2S) \rightarrow \gamma\pi^+\pi^- K^+ K^-$
260 ± 50		⁴ BINON	05 GAMS	$33 \pi^- p \rightarrow \eta\eta n$
144 ± 30		^{9,10} ANISOVICH	03 RVUE	

NODE=M068W

→ UNCHECKED ←

320	+ 50 - 20	10,11	ANISOVICH	03	RVUE		OCCUR=2
102	± 26		TIKHOMIROV	03	SPEC	$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$	
267	± 44	3651	12 NICHITIU	02	OBLX	$0 \bar{p} p \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$	
120	± 26		13 BARBERIS	00E		$450 p p \rightarrow p_f \eta \eta p_S^0$	
220	± 40		14,15 ANISOVICH	99B	SPEC	$0.6-1.2 p \bar{p} \rightarrow \eta \eta \pi^0$	
100	± 25		BARBERIS	99	OMEG	$450 p p \rightarrow p_S p_f K^+ K^-$	
160	± 30		BARBERIS	99B	OMEG	$450 p p \rightarrow p_S p_f \pi^+ \pi^-$	
126	± 16 ± 18		13,16 BARBERIS	99D	OMEG	$450 p p \rightarrow K^+ K^-, \pi^+ \pi^-$	
250	± 140		17 ANISOVICH	98B	RVUE	Compilation	
30	± 7	57	18 BARKOV	98		$\pi^- p \rightarrow K_S^0 K_S^0 n$	
103	± 18 +30 -11		19 BAI	96C	BES	$J/\psi \rightarrow \gamma K^+ K^-$	
85	± 24 +22 -19		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		20 BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	
160	+ 60 - 20		19 BUGG	95	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$	OCCUR=2
264	± 25		21 ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$	
200	to 300		BREAKSTONE	93	SFM	$p p \rightarrow p p \pi^+ \pi^- \pi^+ \pi^-$	
< 80	90% CL		22 ALDE	92D	GAM2	$38 \pi^- p \rightarrow \eta \eta N^*$	
181	± 30		23 ARMSTRONG	89D	OMEG	$300 p p \rightarrow p p K^+ K^-$	
104	± 30		23 ARMSTRONG	89D	OMEG	$300 p p \rightarrow p p K_S^0 K_S^0$	OCCUR=2
166.4 ± 33.2			21 AUGUSTIN	88	DM2	$J/\psi \rightarrow \gamma K^+ K^-, K_S^0 K_S^0$	
30	± 20		19 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		24 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	
184	± 6		25 FALVARD	88	DM2	$J/\psi \rightarrow \phi K^+ K^-, K_S^0 K_S^0$	OCCUR=2
136	± 28		21 AUGUSTIN	87	DM2	$J/\psi \rightarrow \gamma \pi^+ \pi^-$	
130	± 20		19 BALTRUSAIT	87	MRK3	$J/\psi \rightarrow \gamma K^+ K^-$	
122	+ 74 - 15		26 LONGACRE	86	RVUE	$22 \pi^- p \rightarrow n 2 K_S^0$	
57	± 38		27 WILLIAMS	84	MPSF	$200 \pi^- N \rightarrow 2 K_S^0 X$	
160	± 80		BLOOM	83	CBAL	$J/\psi \rightarrow \gamma 2 \eta$	
200	± 100		BURKE	82	MRK2	$J/\psi \rightarrow \gamma 2 \rho$	
220	+ 100 - 70	28,29	EDWARDS	82D	CBAL	$J/\psi \rightarrow \gamma 2 \eta$	
200	+ 156 - 9	30	ETKIN	82B	MPS	$23 \pi^- p \rightarrow n 2 K_S^0$	

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 Breit-Wigner width.

⁵ $J^P = 0^+$, supersedes by ARMSTRONG 89D.

⁶ 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 ($\eta\eta'$).

⁷ Systematic errors not estimated.

⁸ This state may be different from $f_0(1710)$, see CLOSE 05.

⁹ (Solution I)

¹⁰ K-matrix pole, assuming $J^P = 0^+$, 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.

¹¹ Solution I.

¹² Decaying to $f_0(1370)\pi\pi$.

¹³ T-matrix pole.

¹⁴ $J^P = 0^+$.

¹⁵ Not seen by AMSLER 02.

¹⁶ Supersedes BARBERIS 99 and BARBERIS 99B.

¹⁷ T-matrix pole, assuming $J^P = 0^+$

¹⁸ No J^{PC} determination.

¹⁹ $J^P = 2^+$.

²⁰ From a fit to the 0^+ partial wave.

²¹ No J^{PC} determination.

NODE=M068W;LINKAGE=F

NODE=M068W;LINKAGE=G

NODE=M068W;LINKAGE=HE

NODE=M068W;LINKAGE=BW

NODE=M068W;LINKAGE=C3

NODE=M068W;LINKAGE=H

NODE=M068W;LINKAGE=CH

NODE=M068W;LINKAGE=AB

NODE=M068W;LINKAGE=K1

NODE=M068W;LINKAGE=KM

NODE=M068W;LINKAGE=K2

NODE=M068W;LINKAGE=NC

NODE=M068W;LINKAGE=TP

NODE=M068W;LINKAGE=AV

NODE=M068W;LINKAGE=NS

NODE=M068W;LINKAGE=BD

NODE=M068W;LINKAGE=AN

NODE=M068W;LINKAGE=4A

NODE=M068W;LINKAGE=A3

NODE=M068W;LINKAGE=Q0

NODE=M068W;LINKAGE=A1

- 22 ALDE 92D combines all the GAMS-2000 data.
 23 $J^P = 2^+, (0^+ \text{ excluded})$.
 24 From an analysis ignoring interference with $f'_2(1525)$.
 25 From an analysis including interference with $f'_2(1525)$.
 26 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.
 27 No J^{PC} determination.
 28 $J^P = 2^+$ preferred.
 29 From fit neglecting nearby $f'_2(1525)$. Replaced by BLOOM 83.
 30 From an amplitude analysis of the $K_S^0 K_S^0$ system, superseded by LONGACRE 86.

NODE=M068W;LINKAGE=AA
 NODE=M068W;LINKAGE=B
 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

$f_0(1710)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K\bar{K}$	seen
$\Gamma_2 \quad \eta\eta$	seen
$\Gamma_3 \quad \pi\pi$	seen
$\Gamma_4 \quad \gamma\gamma$	seen
$\Gamma_5 \quad \omega\omega$	seen

NODE=M068215;NODE=M068

DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=5;OUR EST;→ UNCHECKED ←
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=4

$f_0(1710) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_1\Gamma_4/\Gamma$
VALUE (eV)					
$12^{+3}_{-2} - 227_8$		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

NODE=M068G2;LINKAGE=F

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_3\Gamma_4/\Gamma$
VALUE (keV)					
<0.82	95	¹ BARATE	00E	ALEP $\gamma\gamma \rightarrow \pi^+ \pi^-$	

¹ Assuming spin 0.

NODE=M068G3
 NODE=M068G3

NODE=M068G;LINKAGE=Z

$f_0(1710)$ BRANCHING RATIOS

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
VALUE					
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

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	Γ_2/Γ
VALUE			
0.22 ± 0.12	ALBALADEJO	08	RVUE
$0.18^{+0.03}_{-0.13}$	¹ LONGACRE	86	RVUE

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

¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles, but assuming spin 2. Fit with constrained inelasticity.

NODE=M068R1
 NODE=M068R1

NODE=M068R1;LINKAGE=L

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

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.NODE=M068R5
NODE=M068R5

OCCUR=2

NODE=M068R5;LINKAGE=A
NODE=M068R5;LINKAGE=L $\Gamma(\pi\pi)/\Gamma(K\bar{K})$ Γ_3/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.23 ± 0.05	OUR AVERAGE			
$0.64 \pm 0.27 \pm 0.18$		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 $pp \rightarrow K^+K^-, \pi^+\pi^-$
0.39 ± 0.14		ARMSTRONG	91	OMEG 300 $pp \rightarrow pp\pi\pi, ppK\bar{K}$
• • • 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 ($0. \bar{p}\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), 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=M068R6
NODE=M068R6NODE=M068R;LINKAGE=AB
NODE=M068R;LINKAGE=CH $\Gamma(\eta\eta)/\Gamma(K\bar{K})$ Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.48 ± 0.15		BARBERIS	00E	450 $pp \rightarrow p_f\eta\eta p_s$
• • • 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 ($0. \bar{p}\bar{p} \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$), 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.NODE=M068R7
NODE=M068R7

NODE=M068R7;LINKAGE=CH

NODE=M068R;LINKAGE=A

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	180	ABLIKIM	06H	BES $J/\psi \rightarrow \gamma\omega\omega$

NODE=M068R3
NODE=M068R3 $\phi_0(1710)$ REFERENCES

NODE=M068

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
LEES	18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=58950
DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)	REFID=56805
ABLIKIM	13N	PR D87 092009	Ablikim M. <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.					
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
BINON	05	PAN 68 960	F. Binon <i>et al.</i>		REFID=50780
Translated from YAF 68 998.					
CLOSE	05	PR D71 094022	F.E. Close, Q. Zhao		REFID=50788
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>		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
BALTRUSAITIS...	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, MPIM)	REFID=20355

NODE=M114

 $\eta(1760)$

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

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	$J/\psi \rightarrow 4\pi\gamma$

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 $J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$	
$\Gamma(\pi^+ \pi^- 2\pi^0)/\Gamma_{\text{total}}$	Γ_3/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen BISELLO 89B DM2 $J/\psi \rightarrow \gamma \pi^+ \pi^- 2\pi^0$	
$\Gamma(\rho^0 \rho^0)/\Gamma_{\text{total}}$	Γ_4/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen BISELLO 89B DM2 $J/\psi \rightarrow \gamma \rho^0 \rho^0$	
seen BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \gamma \rho^0 \rho^0$	
$\Gamma(\rho^+ \rho^-)/\Gamma_{\text{total}}$	Γ_5/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen BISELLO 89B DM2 $J/\psi \rightarrow \gamma \rho^+ \rho^-$	
seen BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \gamma \rho^+ \rho^-$	
$\Gamma(\omega\omega)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE DOCUMENT ID TECN COMMENT	
seen BISELLO 87 DM2 $J/\psi \rightarrow \omega\omega$	
seen BALTRUSAIT..85C MRK3 $J/\psi \rightarrow \gamma\omega\omega$	
$\Gamma(\gamma\gamma)/\Gamma(\omega\omega)$	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=M114R01

NODE=M114R01

NODE=M114R02

NODE=M114R02

NODE=M114R03

NODE=M114R03

NODE=M114R04

NODE=M114R04

NODE=M114R06

NODE=M114R06

NODE=M114R08

NODE=M114R08

¹² Using results from ABLIKIM 06H.

NODE=M114R08;LINKAGE=A

$\eta(1760)$ REFERENCES

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=M114

REFID=58925
REFID=54763
REFID=51125
REFID=40575
REFID=40012
REFID=22009
REFID=22100
REFID=22095

NODE=M075

 $\pi(1800)$

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

See the review on "Non- $q\bar{q}$ Mesons."

NODE=M075

 $\pi(1800)$ MASS

NODE=M075M

NODE=M075M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

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 $\pm$ 14		⁶ BERDNIKOV	94	VES	37 $\pi^- A \rightarrow K^+ K^- \pi^- A$
1873 $\pm$ 33 $\pm$ 20		BELADIDZE	92C	VES	36 $\pi^- Be \rightarrow \pi^- \eta' \eta Be$
1814 $\pm$ 10 $\pm$ 23	426	BITYUKOV	91	VES	36 $\pi^- C \rightarrow \pi^- \eta \eta C$
1770 $\pm$ 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.

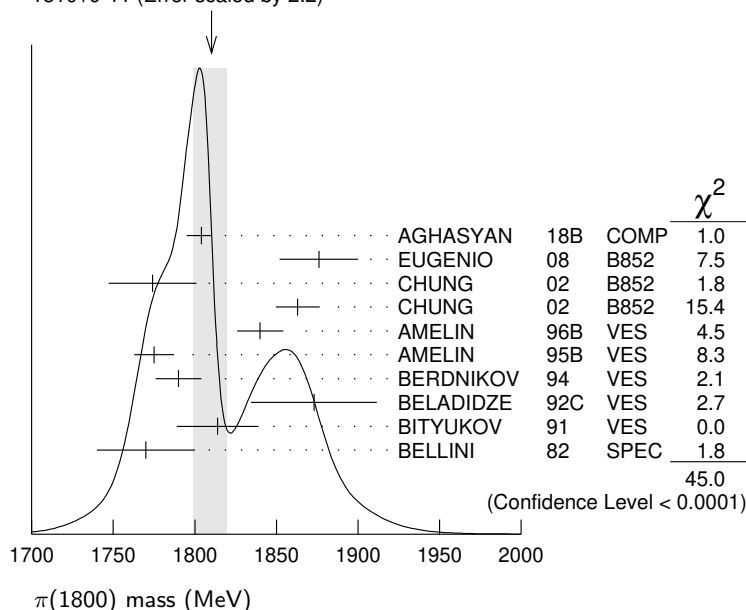
⁵ From a fit to $J^{PC} = 0^-+ f_0(980)\pi, f_0(1370)\pi$ waves.

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

WEIGHTED AVERAGE
1810+9-11 (Error scaled by 2.2)



$\pi(1800)$ WIDTH

NODE=M075W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

NODE=M075W

 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 ± 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 ± 50	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. • • •

$208 \pm 22^{+21}_{-37}$	420k	¹⁴ ALEKSEEV	10	COMP	190 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
$259 \pm 19 \pm 6$		AMELIN	99	VES	37 $\pi^- A \rightarrow \omega \pi^- \pi^0 A^*$

⁸ Statistical error negligible.⁹ From a single-pole fit.¹⁰ In the $f_0(980)\pi$ wave.¹¹ In the $f_0(500)\pi$ wave.¹² From a fit to $J^{PC} = 0^- + f_0(980)\pi, f_0(1370)\pi$ waves.¹³ From a fit to $J^{PC} = 0^- + K_0^*(1430)K^-$ and $f_0(980)\pi^-$ waves.¹⁴ Superseded 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
$\Gamma_8 a_0(980)\eta$	seen
$\Gamma_9 a_2(1320)\eta$	not seen
$\Gamma_{10} f_2(1270)\pi$	not seen
$\Gamma_{11} f_0(1370)\pi^-$	not seen
$\Gamma_{12} f_0(1500)\pi^-$	seen
$\Gamma_{13} \eta \eta'(958)\pi^-$	seen
$\Gamma_{14} K_0^*(1430)K^-$	seen
$\Gamma_{15} K^*(892)K^-$	not seen

DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=11;OUR EST;→ UNCHECKED ←
 DESIG=3;OUR EST;→ UNCHECKED ←
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 DESIG=15
 DESIG=6;OUR EST;→ UNCHECKED ←
 DESIG=8;OUR EST;→ UNCHECKED ←
 DESIG=4
 DESIG=9

 $\pi(1800)$ BRANCHING RATIOS

NODE=M075220

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(500)\pi^-)$	Γ_3/Γ_2
VALUE	DOCUMENT ID TECN COMMENT
$0.44 \pm 0.08 \pm 0.38$	¹⁵ CHUNG 02 B852 18.3 $\pi^- p \rightarrow \pi^+ \pi^- \pi^- p$

NODE=M075R11
 NODE=M075R11

$\Gamma(f_0(980)\pi^-)/\Gamma(f_0(1370)\pi^-)$	Γ_3/Γ_4
VALUE	DOCUMENT ID TECN CHG COMMENT

NODE=M075R5
 NODE=M075R5

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

1.7 ± 1.3	¹⁶ AMELIN	95B	VES	—	36 $\pi^- A \rightarrow \pi^+ \pi^- \pi^- A$

$\Gamma(f_0(1370)\pi^-)/\Gamma_{\text{total}}$	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	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	CL%	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	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	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	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	0.6–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0\pi^0$		
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 $\pi^- \text{Be} \rightarrow \pi^- \eta' \eta \text{Be}$		
0.3 ± 0.1	426 ± 57	16 BITYUKOV 91 VES	36 $\pi^- \text{C} \rightarrow \pi^- \eta \eta \text{C}$		

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 $\pi^- A \rightarrow K^+ K^- \pi^- A$		

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 $\pi^- A \rightarrow K^+ K^- \pi^- A$		

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.)
AMELIN 96B	Translated from YAF 62 487	D.V. Amelin <i>et al.</i>	(SERP, TBIL) IGJPC
AMELIN 95B	Translated from YAF 59 1021	D.V. Amelin <i>et al.</i>	(SERP, TBIL)
BERDNIKOV 94	PL B356 595	E.B. Berdnikov <i>et al.</i>	(SERP, TBIL)
BELADIDZE 92C	PL B337 219	G.M. Beladidze, S.I. Bitiyukov, G.V. Borisov	(SERP+)
BITYUKOV 91	SJNP 55 1535	G.M. Beladidze, S.I. Bitiyukov, G.V. Borisov	(SERP+)
BELLINI 82	Translated from YAF 55 2748	S.I. Bitiyukov <i>et al.</i>	(SERP, TBIL)
	PL B268 137	G. Bellini <i>et al.</i>	(MILA, BGNA, JINR)
	PRL 48 1697		

NODE=M075

REFID=59471
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 REFID=52160
 REFID=48837
 REFID=48318
 REFID=46910

REFID=44725

REFID=44433

REFID=44073

REFID=43175

REFID=41749

REFID=21134

NODE=M038

$f_2(1810)$

$I^G(J^{PC}) = 0^+(2^{++})$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M038

NODE=M038M

NODE=M038M

$f_2(1810)$ 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 $300 \pi^-p \rightarrow \pi^-p4\pi^0$
1806 ±10	1600		ALDE	87 GAM4 $100 \pi^-p \rightarrow 4\pi^0n$
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 ^{+1.6} _{-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	$8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

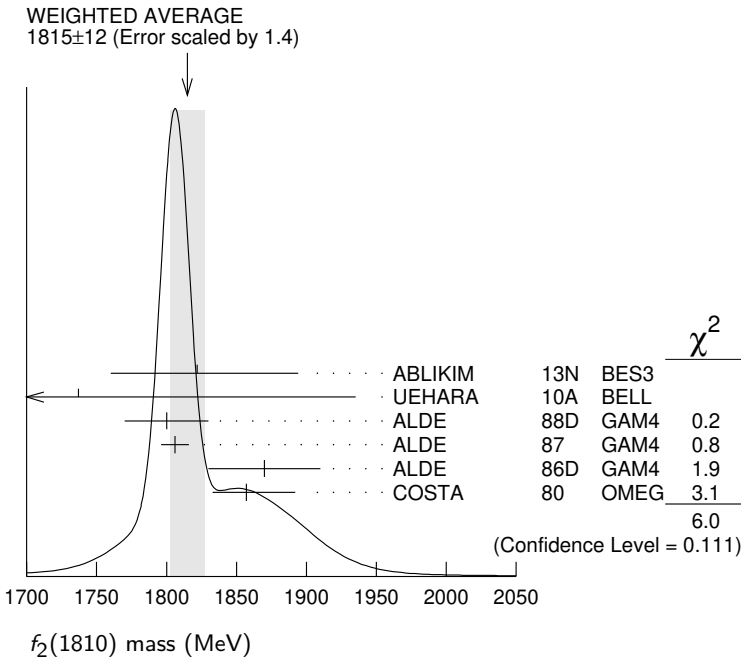
- ¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
- ² Breit-Wigner mass. Could also be the $f_2(1910)$.
- ³ Seen in only one solution.
- ⁴ Error increased by spread of two solutions. Included in LONGACRE 86 global analysis.
- ⁵ T-matrix pole, 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.
- 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=B

NODE=M038M;LINKAGE=UE
NODE=M038M;LINKAGE=F
NODE=M038M;LINKAGE=A
NODE=M038M;LINKAGE=C

NODE=M038M;LINKAGE=L

NODE=M038M;LINKAGE=P1

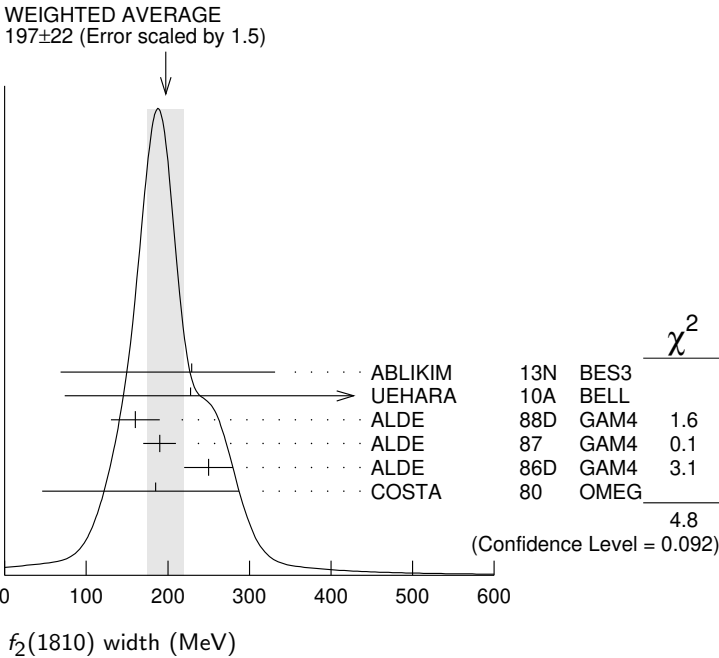


$f_2(1810)$ WIDTH

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	$8 \pi^+p \rightarrow \Delta^{++}\pi^0\pi^0$

- 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.



$f_2(1810)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi\pi$	
$\Gamma_2 \quad \eta\eta$	seen
$\Gamma_3 \quad 4\pi^0$	seen
$\Gamma_4 \quad K^+K^-$	
$\Gamma_5 \quad \gamma\gamma$	seen

NODE=M038W

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

NODE=M038215;NODE=M038

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DESIG=3
DESIG=4;OUR EST;→ UNCHECKED ←
DESIG=1
DESIG=5;OUR EST;→ UNCHECKED ←

$f_2(1810) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M038225

 $\Gamma(\eta\eta) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_5 / \Gamma$

VALUE (eV)

DOCUMENT ID

TECN

COMMENT

 $5.2^{+0.9+37.3}_{-0.8-4.5}$ ¹ UEHARA 10A BELL 10.6 $e^+ e^- \rightarrow e^+ e^- \eta\eta$ NODE=M038G01
NODE=M038G01¹ 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

NODE=M038220

 $\Gamma(\pi\pi) / \Gamma_{\text{total}}$ 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 $\pi^- p \rightarrow \pi^0 \pi^0 n$ $0.21^{+0.02}_{-0.03}$ ¹ LONGACRE 86 RVUE Compilation 0.44 ± 0.03 ² CASON 82 STRC 8 $\pi^+ p \rightarrow \Delta^{++} \pi^0 \pi^0$ NODE=M038R2
NODE=M038R2¹ From a partial-wave analysis of data using a K-matrix formalism with 5 poles. Includes compilation of several other experiments.

NODE=M038R2;LINKAGE=L

² Included in LONGACRE 86 global analysis.

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 CompilationNODE=M038R3
NODE=M038R3¹ 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

 $\Gamma(\pi\pi) / \Gamma(4\pi^0)$ Γ_1 / Γ_3

VALUE

DOCUMENT ID

TECN

COMMENT

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

<0.75

ALDE 87 GAM4 100 $\pi^- p \rightarrow 4\pi^0 n$ NODE=M038R4
NODE=M038R4 $\Gamma(4\pi^0) / \Gamma(\eta\eta)$ Γ_3 / Γ_2

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=M038R5
NODE=M038R5 $\Gamma(K^+ K^-) / \Gamma_{\text{total}}$ Γ_4 / Γ

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 $\pi^- p \rightarrow K^+ K^- n$ NODE=M038R1
NODE=M038R1¹ 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

NODE=M038

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)
ABLIKIM	13N	PR D87 092009	Ablikim M. <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>	
PROKOSHKIN	97	PD 42 117	Y.D. Prokoshkin <i>et al.</i>	(SERP)
ALDE	88D	Translated from DANS 353 323.		
		SJNP 47 810	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE	87	Translated from YAF 47 1273.		
		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)

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)

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

NODE=M085

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

X(1835) MASS

NODE=M085M

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		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		² ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma \gamma \phi(1020)$
1909.5 $\pm$ 15.9 ^{+9.4} _{-27.5}		³ 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		⁴ ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$
1836.5 $\pm$ 3.0 ^{+5.6} _{-2.1}	4265	⁵ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
1877.3 $\pm$ 6.3 ^{+3.4} _{-7.4}		⁶ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta \pi^+ \pi^-)$
1837 ⁺¹⁰ ₋₁₂ $\pm$ 9 ⁺⁹ ₋₇	231	^{7,8} 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 $\pm$ 7		^{8,9} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$
1859 ⁺³ ₋₁₀ $\pm$ 5 ⁺⁵ ₋₂₅		⁸ 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.

NODE=M085M;LINKAGE=B

² From a fit to $\gamma \phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

NODE=M085M;LINKAGE=C

³ 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.

NODE=M085M;LINKAGE=A

⁴ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

NODE=M085M;LINKAGE=AK

⁵ 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=M085M;LINKAGE=AI

⁶ 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 $\eta_2(1870)$.

NODE=M085M;LINKAGE=BL

⁷ 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=M085M;LINKAGE=AE

⁸ 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 $\Upsilon(1S) \rightarrow p\bar{p} \gamma$.

NODE=M085M;LINKAGE=HF

⁹ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

NODE=M085M;LINKAGE=AB

X(1835) WIDTH

NODE=M085W

<u>VALUE (MeV)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
242⁺¹⁴₋₁₅ OUR AVERAGE					
245.2±13.1 ^{+4.6} _{-9.6}			¹ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
192 ⁺²⁰ ₋₁₇ ⁺⁶² ₋₄₃			ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

NODE=M085W

OCCUR=2

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

175 ±57 ±25		² ABLIKIM	18I BES3	$J/\psi \rightarrow \gamma\gamma\phi(1020)$
273.5±21.4 ^{+6.1} _{-64.0}		³ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
83 ±14 ±11	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+\pi^-)$
< 76	90	⁴ ABLIKIM	12D BES3	$J/\psi \rightarrow \gamma p\bar{p}$
190 ± 9 ⁺³⁸ ₋₃₆	4265	⁵ ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
57 ±12 ⁺¹⁹ ₋₄		⁶ ABLIKIM	11J BES3	$J/\psi \rightarrow \omega(\eta\pi^+\pi^-)$
0 ⁺⁴⁴ ₋₀	231	^{7,8} ALEXANDER	10 CLEO	$J/\psi \rightarrow \gamma p\bar{p}$
67.7±20.3± 7.7	264	ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
< 153	90	^{8,9} ABLIKIM	05R BES2	$J/\psi \rightarrow \gamma p\bar{p}$
< 30		⁸ BAI	03F BES2	$J/\psi \rightarrow \gamma p\bar{p}$

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 From a fit to $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

³ 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.

⁴ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Supersedes ABLIKIM 10G.

⁵ 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 $J/\psi \rightarrow \pi^0\pi^+\pi^-\eta'$.

⁶ 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 $\eta_2(1870)$.

⁷ 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.

⁸ 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 $\Upsilon(1S) \rightarrow p\bar{p}\gamma$.

⁹ From the fit including final state interaction effects in isospin 0 S -wave according to SIBIRTSEV 05A. Systematic errors not estimated.

OCCUR=2

NODE=M085W;LINKAGE=B

NODE=M085W;LINKAGE=C

NODE=M085W;LINKAGE=A

NODE=M085W;LINKAGE=AK

NODE=M085W;LINKAGE=AI

NODE=M085W;LINKAGE=BL

NODE=M085W;LINKAGE=AE

NODE=M085W;LINKAGE=HF

NODE=M085W;LINKAGE=AB

X(1835) DECAY MODES

NODE=M085215;NODE=M085

Mode	Fraction (Γ_i/Γ)
Γ_1 $p\bar{p}$	seen
Γ_2 $\eta'\pi^+\pi^-$	seen
Γ_3 $\gamma\gamma$	
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

DESIG=5;OUR EVAL;→ UNCHECKED ←

DESIG=6

DESIG=7

X(1835) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M085225

$\Gamma(\eta'\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_3/\Gamma$
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	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

¹ From a two-resonance fit and constructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

² From a two-resonance fit and destructive interference of the $\eta(1760)$ and $X(1835)$, a significance of 2.8σ .

OCCUR=2

NODE=M085G01;LINKAGE=ZH

NODE=M085G01;LINKAGE=ZA

X(1835) BRANCHING RATIOS

NODE=M085220

$$\Gamma(p\bar{p})/\Gamma(\eta'\pi^+\pi^-)$$

$$\Gamma_1/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.333	ABLIKIM	05R	BES2 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M085R01
NODE=M085R01

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

$$\Gamma_2/\Gamma_4$$

VALUE	DOCUMENT ID	TECN	COMMENT
6.7 ± 1.8	¹ ABLIKIM	15T	BES3 $J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

NODE=M085R00
NODE=M085R00

¹ Using results from ABLIKIM 05R.

NODE=M085R00;LINKAGE=A

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

$$\Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	16J	BES3 $J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M085R03
NODE=M085R03

¹ ABLIKIM 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;LINKAGE=A

$$\Gamma(\gamma\phi(1020))/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	¹ ABLIKIM	18I	BES3 $J/\psi \rightarrow \gamma\gamma\phi(1020)$

NODE=M085R04
NODE=M085R04

¹ Seen as a peak in $\gamma\phi$ invariant mass. Angular analysis consistent with $J^{PC} = 0^{-+}$. Other J^{PC} not excluded.

NODE=M085R04;LINKAGE=A

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

$$\Gamma_3/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9.80 × 10⁻³	90	¹ ABLIKIM	18O	BES3 $\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M085R05
NODE=M085R05

¹ Using results from ABLIKIM 16J.

NODE=M085R05;LINKAGE=A

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

$$\Gamma_6/\Gamma$$

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

NODE=M085

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
REFID=57454
REFID=56785
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REFID=54269
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REFID=54763
REFID=53684
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REFID=52086
REFID=50993
REFID=50985
REFID=50827
REFID=51038
REFID=50651
REFID=49473
REFID=48690
REFID=48980

$\phi_3(1850)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

NODE=M054

 $\phi_3(1850)$ 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 $K \bar{K}^*(892) + \text{c.c.}$	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

$\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

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 $\eta \pi \pi$	
Γ_2 $a_2(1320) \pi$	
Γ_3 $f_2(1270) \eta$	
Γ_4 $a_0(980) \pi$	
Γ_5 $\gamma \gamma$	seen

DESIG=1

DESIG=4

DESIG=8

DESIG=2

DESIG=9

 $\eta_2(1870)$ BRANCHING RATIOS

NODE=M101230

$$\Gamma(a_2(1320)\pi)/\Gamma(f_2(1270)\eta) \quad \Gamma_2/\Gamma_3$$

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

NODE=M101R2;LINKAGE=AN

$$\Gamma(a_2(1320)\pi)/\Gamma(a_0(980)\pi) \quad \Gamma_2/\Gamma_4$$

VALUE	DOCUMENT ID	COMMENT
32.6±12.6	BARBERIS	00B 450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$

NODE=M101R4

NODE=M101R4

$$\Gamma(a_0(980)\pi)/\Gamma(f_2(1270)\eta) \quad \Gamma_4/\Gamma_3$$

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

NODE=M101R01;LINKAGE=AN

$$\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	KARCH	92 CBAL	$e^+e^- \rightarrow e^+e^- \eta \pi^0 \pi^0$

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.

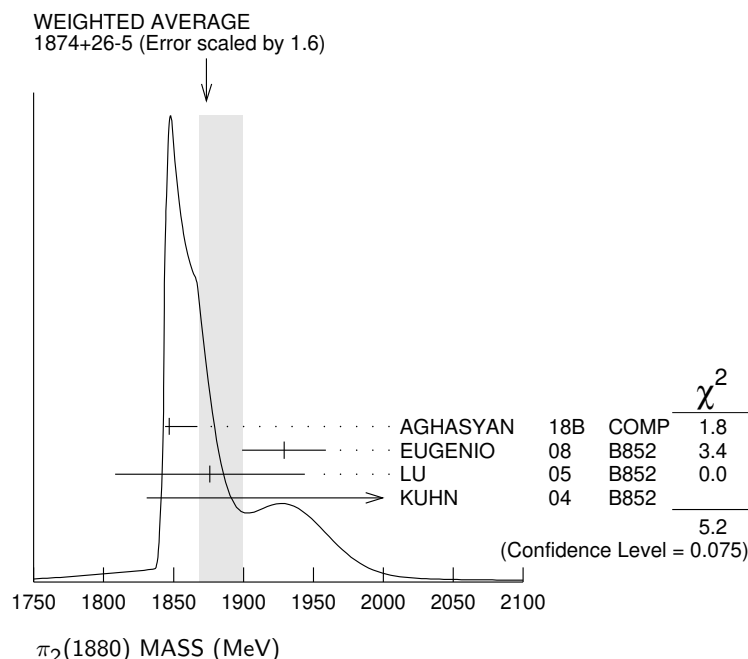
1847 ⁺²⁰ ₋₃	46M	¹ AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$
1929 $\pm$ 24 $\pm$ 18	4k	EUGENIO	08	B852	18 $\pi^- p \rightarrow \eta \eta \pi^- p$
1876 $\pm$ 11 $\pm$ 67	145k	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$
2003 $\pm$ 88 $\pm$ 148	69k	KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

• • • 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	
Γ_1	$\eta\eta\pi^-$
Γ_2	$a_0(980)\eta$
Γ_3	$a_2(1320)\eta$
Γ_4	$f_0(1500)\pi$
Γ_5	$f_1(1285)\pi$
Γ_6	$\omega\pi^-\pi^0$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

 $\Gamma(a_2(1320)\eta)/\Gamma(f_1(1285)\pi)$ 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

 $\rho(1900)$

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

NODE=M170

OMITTED FROM SUMMARY TABLE

See our mini-review under the $\rho(1700)$.

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. • • •

1909±17±25	54	¹ 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		^{2,3} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
1870±10		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

¹ From the fit with two resonances.² From a fit with two resonances with the JACOB 72 continuum.³ Supersedes FRABETTI 01.

OCCUR=2

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. • • •

48±17±2	54	⁴ 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		^{5,6} FRABETTI	04	E687	$\gamma p \rightarrow 3\pi^+3\pi^-p$
10±5		ANTONELLI	96	SPEC	$e^+e^- \rightarrow \text{hadrons}$

⁴ From the fit with two resonances.⁵ From a fit with two resonances with the JACOB 72 continuum.⁶ Supersedes FRABETTI 01.

NODE=M170W

OCCUR=2

NODE=M170W;LINKAGE=AU

NODE=M170W;LINKAGE=PI

NODE=M170W;LINKAGE=RS

$\rho(1900) \Gamma(i)\Gamma(e^+ e^-)/\Gamma^2(\text{total})$					
$\Gamma(\phi\pi)/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$				$\Gamma_4/\Gamma \times \Gamma_6/\Gamma$	
<u>VALUE (units 10^{-8})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.2 \pm 1.2 \pm 0.8$	54	⁷ AUBERT	08S BABR	$10.6 e^+ e^- \rightarrow \phi \pi^0 \gamma$	
⁷ From the fit with two resonances.					

NODE=M170215

NODE=M170B01
NODE=M170B01

NODE=M170B01;LINKAGE=AU

NODE=M170225;NODE=M170

$\rho(1900) \text{ DECAY MODES}$		
Mode	Fraction (Γ_i/Γ)	
$\Gamma_1 \quad 6\pi$	seen	
$\Gamma_2 \quad 3\pi^+3\pi^-$	seen	
$\Gamma_3 \quad 2\pi^+2\pi^-2\pi^0$		
$\Gamma_4 \quad \phi\pi$		
$\Gamma_5 \quad \text{hadrons}$	seen	
$\Gamma_6 \quad e^+e^-$	seen	
$\Gamma_7 \quad \overline{N}N$	not seen	

DESIG=5;OUR EST;→ UNCHECKED ←
DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=6
DESIG=7
DESIG=2;OUR EST;→ UNCHECKED ←
DESIG=3;OUR EST;→ UNCHECKED ←
DESIG=4;OUR EST;→ UNCHECKED ←

$\rho(1900) \text{ BRANCHING RATIOS}$					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

$\rho(1900) \text{ REFERENCES}$				
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=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				
$f_2(1910)$ $\omega\omega$ MODE				
<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1900$\pm$ 9 OUR AVERAGE	Error includes scale factor of 1.4. See the ideogram below.			
1890 $\pm$ 10	¹ AMELIN	06	VES	36 $\pi^- p \rightarrow \omega\omega n$
1897 $\pm$ 11	BARBERIS	00F		450 $pp \rightarrow p_f \omega\omega p_s$
1924 $\pm$ 14	ALDE	90	GAM2	38 $\pi^- p \rightarrow \omega\omega n$

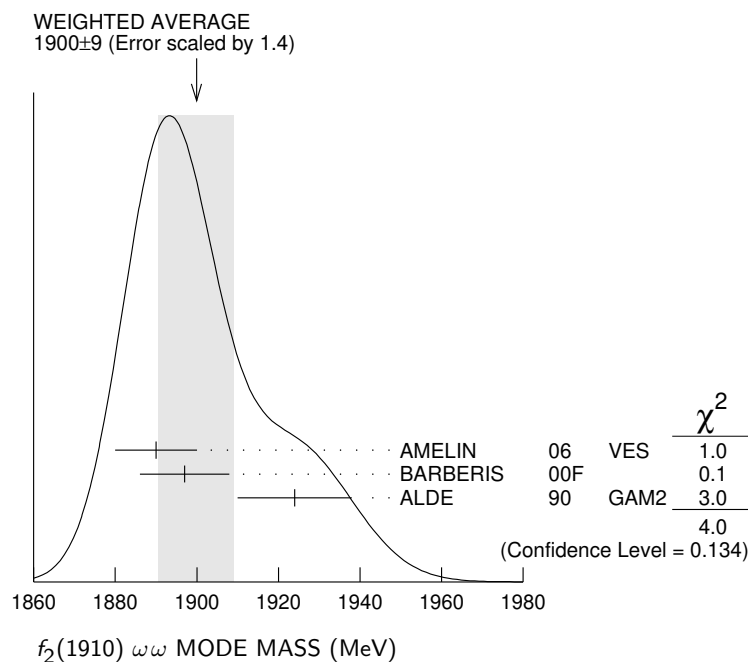
NODE=M142205

NODE=M142MX

NODE=M142M2
NODE=M142M2

¹ Supersedes BELADIDZE 92B.

NODE=M142M2;LINKAGE=AM

 **$f_2(1910) \eta\eta'$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1934±16	¹ BARBERIS	00A	450 $pp \rightarrow p_f \eta \eta' p_s$
• • • 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
NODE=M142M3 **$f_2(1910) K^+ K^-$ MODE**

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=M142M3;LINKAGE=KS
NODE=M142M3;LINKAGE=ANNODE=M142M4
NODE=M142M4

NODE=M142M4;LINKAGE=A

 $f_2(1910)$ WIDTH

NODE=M142210

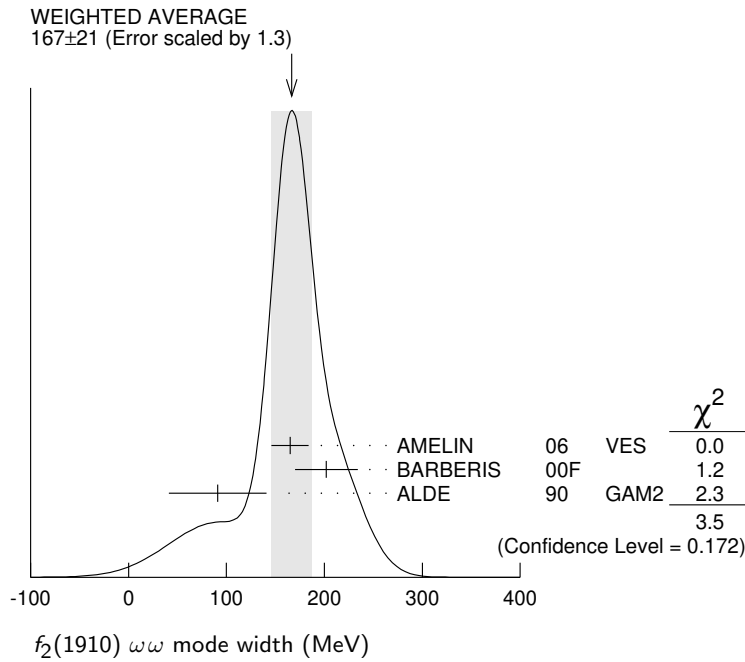
NODE=M142WX

 $f_2(1910) \omega\omega$ 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
NODE=M142W2

NODE=M142W2;LINKAGE=AM



$f_2(1910) \eta\eta'$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
141±41	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. • • •			
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

$f_2(1910) K^+ K^-$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
120±40	AMSLER	06	CBAR 1.64 $\bar{p} p \rightarrow K^+ K^- \pi^0$

NODE=M142W4
NODE=M142W4

$f_2(1910)$ DECAY MODES

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

NODE=M142215;NODE=M142

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

$\Gamma(K^+ K^-)/\Gamma_{\text{total}}$				Γ_2/Γ
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

$\Gamma(K_S^0 K_S^0)/\Gamma(\eta\eta')$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.066	90	BALOSHIN	86	SPEC $40\pi p \rightarrow K_S^0 K_S^0 n$

Γ_3/Γ_6

NODE=M142R7
NODE=M142R7

$\Gamma(\eta\eta)/\Gamma(\eta\eta')$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.05	90	ALDE	91B	GAM2 $38\pi^- p \rightarrow \eta\eta' n$

Γ_4/Γ_6

NODE=M142R6
NODE=M142R6

$\Gamma(\omega\omega)/\Gamma(\eta\eta')$

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6 ± 0.6	BARBERIS 00F	450 $pp \rightarrow p_f \omega \omega p_s$

Γ_5/Γ_6

NODE=M142R10
NODE=M142R10

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

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

Γ_7/Γ

NODE=M142R8
NODE=M142R8

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
2.6 ± 0.4	BARBERIS 00F	450 $pp \rightarrow p_f \omega \omega p_s$

Γ_8/Γ_5

NODE=M142R9
NODE=M142R9

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.09 ± 0.05	¹ ANISOVICH 11	SPEC	0.9–1.94 $p\bar{p}$

Γ_{10}/Γ_9

NODE=M142R12
NODE=M142R12

¹ Reanalysis of ADOMEIT 96 and ANISOVICH 00E.

NODE=M142R12;LINKAGE=AN

$f_2(1910)$ REFERENCES

ANISOVICH 11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
AMELIN 06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
Translated from YAF 69 715.			
AMSLER 06	PL B639 165	C. Amsler <i>et al.</i>	(Crystal Barrel Collab.)
ANISOVICH 00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
ANISOVICH 00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
BARBERIS 00A	PL B471 429	D. Barberis <i>et al.</i>	(WA 102 Collab.)
BARBERIS 00F	PL B484 198	D. Barberis <i>et al.</i>	(WA 102 Collab.)
ADOMEIT 96	ZPHY C71 227	J. Adomeit <i>et al.</i>	(Crystal Barrel Collab.)
BELADIDZE 92B	ZPHY C54 367	G.M. Beladidze <i>et al.</i>	(VES Collab.)
BELADIDZE 92D	ZPHY C57 13	G.M. Beladidze <i>et al.</i>	(VES Collab.)
ALDE 91B	SJNP 54 455	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
Translated from YAF 54 751.			
Also	PL B276 375	D.M. Alde <i>et al.</i>	(BELG, SERP, KEK, LANL+)
ALDE 90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
ALDE 89	PL B216 447	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP)
Also	SJNP 48 1035	D.M. Alde <i>et al.</i>	(BELG, SERP, LANL, LAPP)
Translated from YAF 48 1724.			
BALOSHIN 86	SJNP 43 959	O.N. Baloshin <i>et al.</i>	(ITEP)
Translated from YAF 43 1487.			

NODE=M142

REFID=53631
REFID=51574

REFID=51136
REFID=47945
REFID=47950
REFID=47957
REFID=47962
REFID=45202
REFID=42172
REFID=43309
REFID=41844

REFID=41911
REFID=40935
REFID=40727
REFID=44697

REFID=40734

$a_0(1950)$

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

OMITTED FROM SUMMARY TABLE

Needs confirmation. Seen in $\gamma\gamma \rightarrow \eta_c(1S) \rightarrow K\bar{K}\pi$ by LEES 16A
with significance 2.5σ in $K_S^0 K^\pm \pi^\mp$ and 4.2σ 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
$271 \pm 22 \pm 29$	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

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
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
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 *et al.* (BABAR Collab.)

REFID=57125

NODE=M135

$f_2(1950)$

$I^G(J^{PC}) = 0^+(2^{++})$

$f_2(1950)$ MASS

NODE=M135M

NODE=M135M

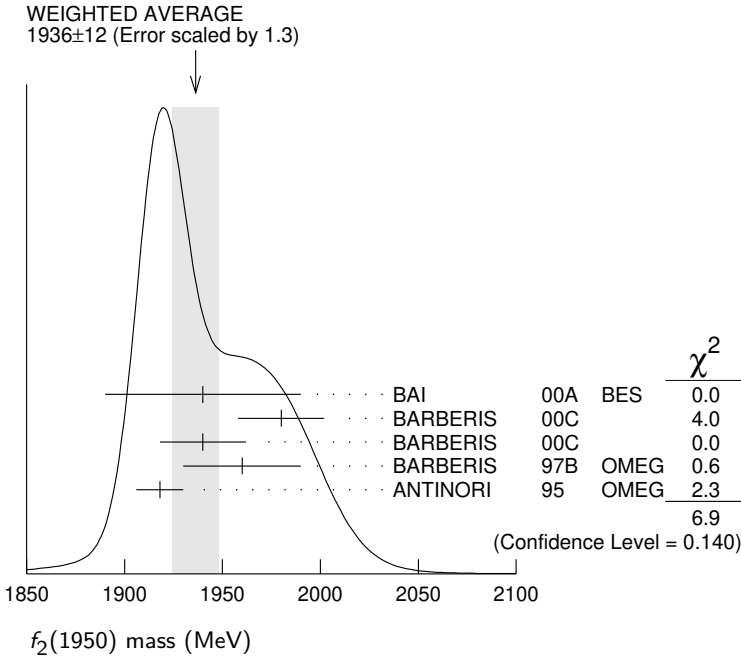
VALUE (MeV)	DOCUMENT	ID	TECN	COMMENT
1936 ±12 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
1940 ±50	BAI	00A	BES	$J/\psi \rightarrow \gamma(\pi^+\pi^-\pi^+\pi^-)$
1980 ±22	¹ BARBERIS	00C		$450\ pp \rightarrow pp4\pi$
1940 ±22	² BARBERIS	00C		$450\ pp \rightarrow pp2\pi2\pi^0$
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. • • •				
1978.2± 1.8 ^{+28.4} _{-16.9}	³ ALBRECHT	20	RVUE	$0.9\ \bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
2038 ⁺¹³ ₋₁₁ ⁺¹² ₋₇₃	⁴ UEHARA	09	BELL	$10.6\ e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
1930 ±25	⁵ BINON	05	GAMS	$33\ \pi^-p \rightarrow \eta\eta n$
1980 ± 2 ±14	ABE	04	BELL	$10.6\ e^+e^- \rightarrow e^+e^-K^+K^-$
1867 ±46	⁶ AMSLER	02	CBAR	$0.9\ \bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
2010 ±25	ANISOVICH	00J	SPEC	
1980 ±50	ANISOVICH	99B	SPEC	$1.35\text{--}1.94\ p\bar{p} \rightarrow \eta\eta\pi^0$
~ 1990	⁷ OAKDEN	94	RVUE	$0.36\text{--}1.55\ \bar{p}p \rightarrow \pi\pi$
1950 ±15	⁸ ASTON	91	LASS	$11\ K^-\rho \rightarrow \Lambda K\bar{K}\pi\pi$
¹ Decaying into $\pi^+\pi^-2\pi^0$.				
² Decaying into $2(\pi^+\pi^-)$.				
³ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$).				
⁴ Taking into account $f_4(2050)$.				
⁵ First solution, PWA is ambiguous.				
⁶ T-matrix pole.				
⁷ 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.				
⁸ Cannot determine spin to be 2.				

OCCUR=2

NODE=M135M;LINKAGE=A4
NODE=M135M;LINKAGE=B4
NODE=M135M;LINKAGE=B

NODE=M135M;LINKAGE=UE
NODE=M135M;LINKAGE=BI
NODE=M135M;LINKAGE=E
NODE=M135M;LINKAGE=BB

NODE=M135M;LINKAGE=A



$f_2(1950)$ WIDTH

NODE=M135W

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 $p\bar{p} \rightarrow p\bar{p}4\pi$
485 ± 55	² BARBERIS	00C	450 $p\bar{p} \rightarrow p\bar{p}4\pi$
460 ± 40	BARBERIS	97B	OMEG 450 $p\bar{p} \rightarrow p\bar{p}2(\pi^+\pi^-)$
390 ± 60	ANTINORI	95	OMEG 300,450 $p\bar{p} \rightarrow p\bar{p}2(\pi^+\pi^-)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
237.6 ± 1.6 $^{+41.6}_{-15.5}$	³ ALBRECHT	20	RVUE 0.9 $\bar{p}p \rightarrow \pi^0\pi^0\eta, \pi^0\eta\eta, \pi^0K^+K^-$
441 $^{+27}_{-25}$ $^{+28}_{-192}$	⁴ UEHARA	09	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
450 ± 50	⁵ BINON	05	GAMS 33 $\pi^-p \rightarrow \eta\eta n$
297 ± 12 ± 6	ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^-\pi^0\pi^0$
385 ± 58	⁶ AMSLER	02	CBAR 0.9 $\bar{p}p \rightarrow \pi^0\eta\eta, \pi^0\pi^0\pi^0$
495 ± 35	ANISOVICH	00J	SPEC
500 ± 100	ANISOVICH	99B	SPEC 1.35–1.94 $p\bar{p} \rightarrow \eta\eta\pi^0$
~ 100	⁷ OAKDEN	94	RVUE 0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
250 ± 50	⁸ ASTON	91	LASS 11 $K^-p \rightarrow \Lambda K\bar{K}\pi\pi$
¹ Decaying into $\pi^+\pi^-2\pi^0$. ² Decaying into $2(\pi^+\pi^-)$. ³ T-matrix pole, 4 poles, 4 channels, including scattering data from HYAMS 75 ($\pi\pi$), LONGACRE 86 ($K\bar{K}$), BINON 83 ($\eta\eta$). ⁴ Taking into account $f_4(2050)$. ⁵ First solution, PWA is ambiguous. ⁶ T-matrix pole. ⁷ 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. ⁸ Cannot determine spin to be 2.			

NODE=M135W

OCCUR=2

NODE=M135W;LINKAGE=A4
 NODE=M135W;LINKAGE=B4
 NODE=M135W;LINKAGE=B

NODE=M135W;LINKAGE=UE
 NODE=M135W;LINKAGE=BI
 NODE=M135W;LINKAGE=TT
 NODE=M135W;LINKAGE=BB

NODE=M135W;LINKAGE=A

 $f_2(1950)$ DECAY MODES

NODE=M135215;NODE=M135

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 $f_2(1270)\pi\pi$	
Γ_9 $\eta\eta$	seen
Γ_{10} $K\bar{K}$	seen
Γ_{11} $\gamma\gamma$	seen
Γ_{12} $\rho\bar{\rho}$	seen

DESIG=1
 DESIG=11
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=10;OUR EST;→ UNCHECKED ←
 DESIG=7;OUR EST;→ UNCHECKED ←
 DESIG=3
 DESIG=4
 DESIG=5
 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

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_{10}\Gamma_{11}/\Gamma$
VALUE (eV)	DOCUMENT ID TECN COMMENT

NODE=M135G1
 NODE=M135G1

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
122 ± 4 ± 26	¹ ABE	04	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$
¹ Assuming spin 2.			

NODE=M135G1;LINKAGE=AB

$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_{11}/\Gamma$
VALUE	DOCUMENT ID TECN COMMENT

NODE=M135G2
 NODE=M135G2

● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
162 $^{+69}_{-42}$ $^{+1137}_{-204}$	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** NODE=M135R1
NODE=M135R1

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
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** NODE=M135R3
NODE=M135R3

VALUE	DOCUMENT ID	TECN	COMMENT

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

not seen	BARBERIS	00B	450 $pp \rightarrow p_f \eta \pi^+ \pi^- p_s$
not seen	BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_s$
possibly seen	BARBERIS	97B OMEG	450 $pp \rightarrow p p 2(\pi^+ \pi^-)$

 $\Gamma(\eta\eta)/\Gamma(4\pi)$ **Γ_9/Γ_5** NODE=M135R5
NODE=M135R5

VALUE	CL%	DOCUMENT ID	COMMENT

• • • 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_9/Γ_3** NODE=M135R6
NODE=M135R6

VALUE	DOCUMENT ID	TECN	COMMENT

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_{12}/Γ** NODE=M135R07
NODE=M135R07

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	111	ALEXANDER	10	CLEO $\psi(2S) \rightarrow \gamma p \bar{p}$

 $f_2(1950)$ REFERENCES

NODE=M135

ALBRECHT	20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel 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>	
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)

REFID=60439
REFID=53525
REFID=52761
REFID=50780

REFID=49650
REFID=48580
REFID=47950
REFID=47426
REFID=47958
REFID=47959
REFID=47961
REFID=46886
REFID=45758
REFID=45212
REFID=44437
REFID=45210
REFID=41746
REFID=20768
REFID=20750
REFID=20355

NODE=M017

 $a_4(1970)$

$$I^G(J^{PC}) = 1^-(4^{++})$$

was $a_4(2040)$ **$a_4(1970)$ 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	$191 \pi^- p \rightarrow \eta^{(\prime)} \pi^- p$
$1985 \pm 10 \pm 13$	145k	LU	05	B852	$18 \pi^- p \rightarrow \omega \pi^- \pi^0 p$
$1996 \pm 25 \pm 43$		CHUNG	02	B852	$18.3 \pi^- p \rightarrow 3\pi p$
$2000 \pm 40^{+60}_{-20}$		IVANOV	01	B852	$18 \pi^- p \rightarrow \eta' \pi^- p$
2010 ± 20		² DONSKOV	96	GAM2 0	$38 \pi^- p \rightarrow \eta \pi^0 n$
2040 ± 30		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. • • •

$1885 \pm 13^{+50}_{-2}$	420k	⁴ ALEKSEEV	10	COMP	$190 \pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
2004 ± 6	80k	⁵ UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi_0^0$
2005^{+25}_{-45}		⁶ ANISOVICH	01F	SPEC	$2.0 \bar{p} p \rightarrow 3\pi^0, \pi^0 \eta, \pi^0 \eta'$
$1944 \pm 8 \pm 50$		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.

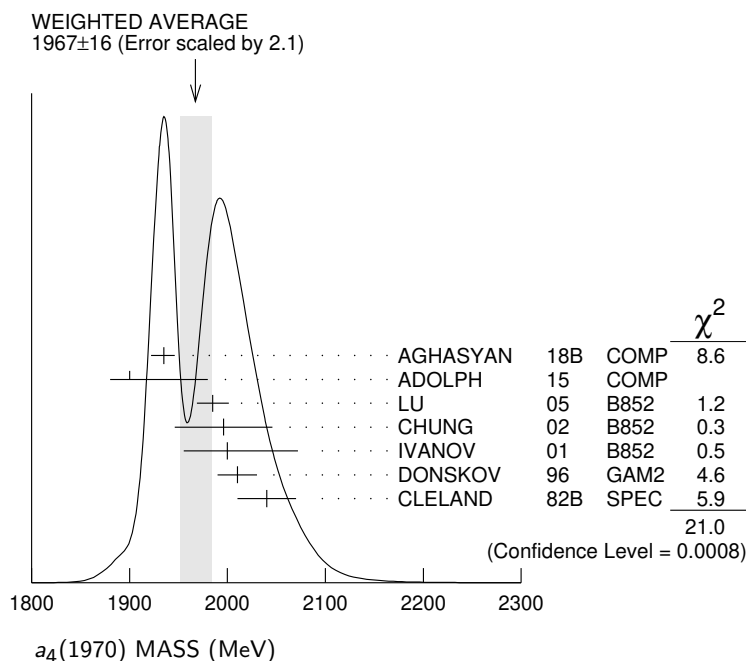
⁶ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.

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 DONSKOV	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 $\pi^- Pb \rightarrow \pi^- \pi^- \pi^+ Pb'$
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	EVTS 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

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

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	DONSKOV	96	GAM2	0 38 $\pi^- p \rightarrow \eta\pi^0 n$

 Γ_7/Γ

NODE=M017R3
 NODE=M017R3

 $\Gamma(\eta'(958)\pi)/\Gamma(\eta\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.23±0.07	ADOLPH	15	COMP 191 $\pi^- p \rightarrow \eta^{(\prime)}\pi^- p$

 Γ_8/Γ_7

NODE=M017R01
 NODE=M017R01

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	145k	LU	05	B852 18 $\pi^- p \rightarrow \omega\pi^-\pi^0 p$

 Γ_6/Γ

NODE=M017R5
 NODE=M017R5

 $a_4(1970)$ REFERENCES

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>	
DONSKOV	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

NODE=M017

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

 $\rho_3(1990)$

$$I^G(J^{PC}) = 1^+(3^{--})$$

OMITTED FROM SUMMARY TABLE

NODE=M167

 $\rho_3(1990)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

$$1982 \pm 14 \quad {}^1 \text{ANISOVICH} \quad 02 \quad \text{SPEC} \quad 0.6\text{--}1.9 \quad p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$$

$$\sim 2007 \quad \text{HASAN} \quad 94 \quad \text{RVUE} \quad \bar{p}p \rightarrow \pi\pi$$

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167M

NODE=M167M

NODE=M167M;LINKAGE=AY

 $\rho_3(1990)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

$$188 \pm 24 \quad {}^2 \text{ANISOVICH} \quad 02 \quad \text{SPEC} \quad 0.6\text{--}1.9 \quad p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$$

$$\sim 287 \quad \text{HASAN} \quad 94 \quad \text{RVUE} \quad \bar{p}p \rightarrow \pi\pi$$

² From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M167W

NODE=M167W

NODE=M167W;LINKAGE=AY

 $\rho_3(1990)$ 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+)
HASAN	94	PL B334 215	A. Hasan, D.V. Bugg	(LOQM)

NODE=M167

REFID=48828
 REFID=48327
 REFID=48349
 REFID=47950
 REFID=44103

$\pi_2(2005)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

NODE=M239

OMITTED FROM SUMMARY TABLE

 $\pi_2(2005)$ MASS

NODE=M239M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M239M

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 $\pm$ 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

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M239W

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 $\pm$ 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

$\Gamma(\pi^- \pi^+ \pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen	AGHASYAN	18B	COMP	190 $\pi^- p \rightarrow \pi^- \pi^+ \pi^- p$

NODE=M239R00
NODE=M239R00

$\Gamma(\omega \pi^0 \pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
seen	LU	05	B852	18 $\pi^- p \rightarrow \omega \pi^- \pi^0 p$

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

NODE=M106

$f_2(2010)$

$I^G(J^{PC}) = 0^+(2^{++})$

$f_2(2010)$ MASS

NODE=M106M

NODE=M106M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2011⁺⁶²₋₇₆	¹ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2005 $\pm$ 12	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
1980 $\pm$ 20	² BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
2050 ⁺⁹⁰ ₋₅₀	ETKIN	85 MPS	22 $\pi^- p \rightarrow 2 \phi n$
2120 ⁺²⁰ ₋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^{+1}_{-3} , 0^{+1}_{-0} , and 2^{+2}_{-1} , respectively.			
² Statistically very weak, only 1.4 s.d.			

NODE=M106M;LINKAGE=C

NODE=M106M;LINKAGE=E

$f_2(2010)$ WIDTH

NODE=M106W

NODE=M106W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
202⁺⁶⁷₋₆₂	³ ETKIN	88 MPS	22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
209 $\pm$ 32	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
145 $\pm$ 50	⁴ BOLONKIN	88 SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$
200 ⁺¹⁶⁰ ₋₅₀	ETKIN	85 MPS	22 $\pi^- p \rightarrow 2 \phi n$
300 ⁺¹⁵⁰ ₋₅₀	LINDENBAUM	84 RVUE	
310 $\pm$ 70	ETKIN	82 MPS	22 $\pi^- p \rightarrow 2 \phi n$
³ Includes data of ETKIN 85.			
⁴ Statistically very weak, only 1.4 s.d.			

NODE=M106W;LINKAGE=C

NODE=M106W;LINKAGE=E

$f_2(2010)$ DECAY MODES

NODE=M106215;NODE=M106

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi \phi$	seen
$\Gamma_2 \quad K \bar{K}$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

$f_2(2010)$ BRANCHING RATIOS

NODE=M106230

NODE=M106R01

NODE=M106R01

$\Gamma(K\bar{K})/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ
VALUE				
seen	VLADIMIRSK...06	SPEC	40 $\pi^- p \rightarrow K_S^0 K_S^0 n$	

$f_2(2010)$ REFERENCES

NODE=M106

REFID=51191

REFID=40580

REFID=40285

REFID=21871

REFID=21869

REFID=21866

REFID=21867

VLADIMIRSK... 06	PAN 69 493	V.V. Vladimirsky <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)

$f_0(2020)$

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

OMITTED FROM SUMMARY TABLE
Needs confirmation.

 $f_0(2020)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1992±16		^{1,2} BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1910±50		³ ROPERTZ	18 RVUE	$\bar{B}_s^0 \rightarrow J/\psi(\pi^+\pi^-/K^+K^-)$
2037±8	80k	⁴ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
2040±38		ANISOVICH	00J SPEC	
2010±60		ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0n$
2020±35		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$

¹ Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.² T-matrix pole.³ T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.⁴ Statistical error only. **$f_0(2020)$ WIDTH**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
442±60		^{1,2} BARBERIS	00C	450 $pp \rightarrow p_f 4\pi p_S$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
400±80		³ ROPERTZ	18 RVUE	$\bar{B}_s^0 \rightarrow J/\psi(\pi^+\pi^-/K^+K^-)$
296±17	80k	⁴ UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$
405±40		ANISOVICH	00J SPEC	
240±100		ALDE	98 GAM4	100 $\pi^-p \rightarrow \pi^0\pi^0n$
410±50		BARBERIS	97B OMEG	450 $pp \rightarrow pp2(\pi^+\pi^-)$

¹ Average between $\pi^+\pi^-2\pi^0$ and $2(\pi^+\pi^-)$.² T-matrix pole.³ T-matrix pole of 3 channel unitary model fit to data from AAIJ 14BR and AAIJ 17V extracted using Pade approximants.⁴ Statistical error only. **$f_0(2020)$ DECAY MODES**

Mode	Fraction (Γ_i/Γ)
Γ_1 $\rho\pi\pi^0$	seen
Γ_2 $\pi^0\pi^0$	seen
Γ_3 $\rho\rho$	seen
Γ_4 $\omega\omega$	seen
Γ_5 $\eta\eta$	seen

 $f_0(2020)$ BRANCHING RATIOS

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$ **Γ_3/Γ_4**

VALUE	DOCUMENT ID	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •		
~3	BARBERIS	00F 450 $pp \rightarrow p_f \omega \omega p_S$

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

VALUE	DOCUMENT ID	TECN	COMMENT
seen	UMAN	06 E835	5.2 $\bar{p}p \rightarrow \eta\eta\pi^0$

 $f_0(2020)$ REFERENCES

ROPERTZ	18	EPJ C78 1000	S. Ropertz, C. Hanhart, B. Kubis	(BONN, JULI)
AAIJ	17V	JHEP 1708 037	R. Aaij et al.	(LHCb Collab.)
AAIJ	14BR	PR D89 092006	R. Aaij et al.	(LHCb Collab.)
UMAN	06	PR D73 052009	I. Uman et al.	(FNAL E835)
ANISOVICH	00J	PL B491 47	A.V. Anisovich et al.	(RAL, LOQM, PNPI+)
BARBERIS	00C	PL B471 440	D. Barberis et al.	(WA 102 Collab.)
BARBERIS	00F	PL B484 198	D. Barberis et al.	(WA 102 Collab.)
ALDE	98	EPJ A3 361	D. Alde et al.	(GAM4 Collab.)
Also		PAN 62 405	D. Alde et al.	(GAMS Collab.)
BARBERIS	97B	Translated from YAF 62 446	D. Barberis et al.	(WA 102 Collab.)
		PL B413 217		

NODE=M156

NODE=M156

NODE=M156M

NODE=M156M

NODE=M156M;LINKAGE=PC

NODE=M156M;LINKAGE=PP

NODE=M156M;LINKAGE=A

NODE=M156M;LINKAGE=ST

NODE=M156W

NODE=M156W

NODE=M156W;LINKAGE=PC

NODE=M156W;LINKAGE=PP

NODE=M156W;LINKAGE=A

NODE=M156W;LINKAGE=ST

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

NODE=M156220

NODE=M156R1

NODE=M156R1

NODE=M156R01

NODE=M156R01

NODE=M156

REFID=59332

REFID=57828

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 $\pi^- p \rightarrow n 2 K_S^0$
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 $\pi^- p \rightarrow p 3 \pi$

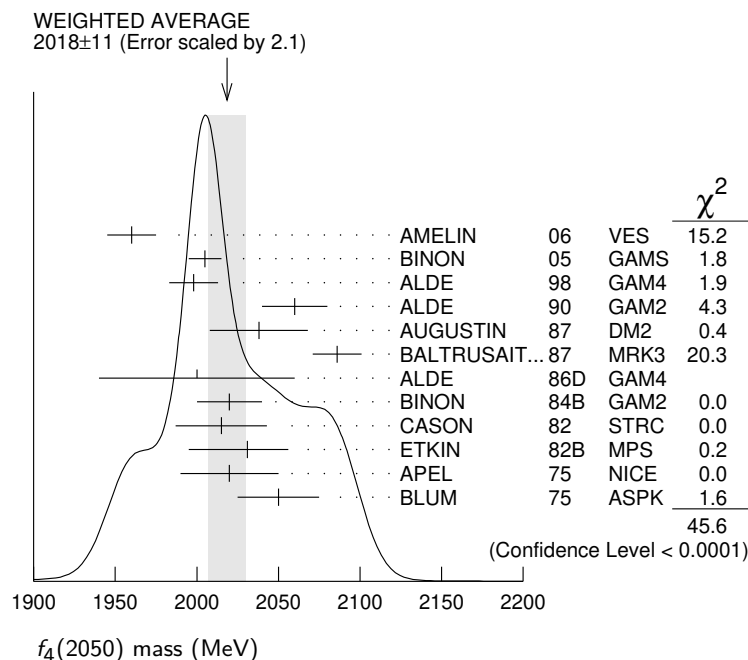
¹ From the first PWA solution.² From a partial-wave analysis of the data.³ From an amplitude analysis of the reaction $\pi^+ \pi^- \rightarrow 2 \pi^0$.⁴ K matrix pole.⁵ Taking into account the $f_2(1950)$. Helicity-2 production favored.⁶ Energy-dependent analysis.⁷ Single energy analysis.⁸ From solution 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.

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

OCCUR=2



$f_4(2050)$ 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.

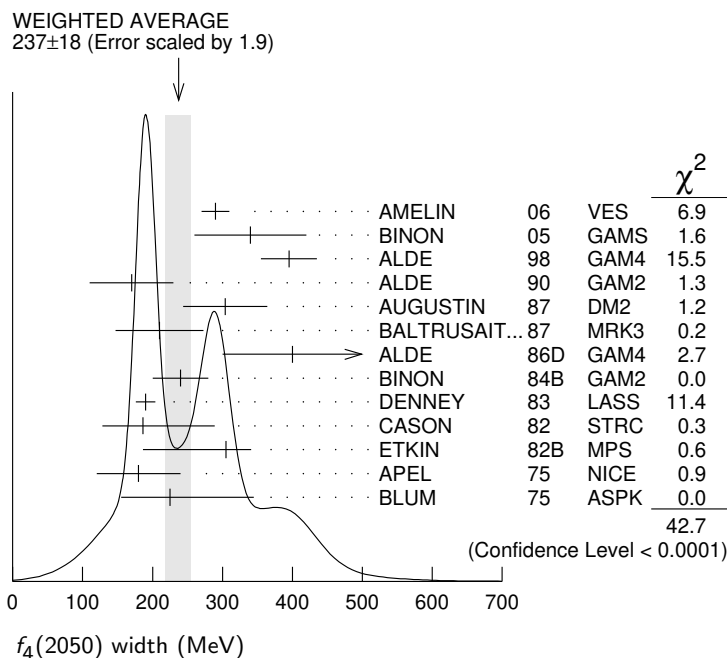
OCCUR=2

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

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

TECN

83C

COMMENT

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

 $f_4(2050)$ REFERENCES

NODE=M016

ANISOVICH	09	IJMP A24 2481	V.V. Anisovich, A.V. Sarantsev	
UEHARA	09	PR D79 052009	S. Uehara <i>et al.</i>	(BELLE Collab.)
AMELIN	06	PAN 69 690	D.V. Amelin <i>et al.</i>	(VES Collab.)
		Translated from YAF 69 715.		
BINON	05	PAN 68 960	F. Binon <i>et al.</i>	
		Translated from YAF 68 998.		
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.)
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.		
MARTIN	98	PR C57 3492	B.R. Martin <i>et al.</i>	
MARTIN	97	PR C56 1114	B.R. Martin, G.C. Oades	(LOUC, AARH)
KLOET	96	PR D53 6120	W.M. Kloet, F. Myhrer	(RUTG, NORD)
OAKDEN	94	NP A574 731	M.N. Oakden, M.R. Pennington	(DURH)
ALDE	90	PL B241 600	D.M. Alde <i>et al.</i>	(SERP, BELG, LANL, LAPP+)
OEST	90	ZPHY C47 343	T. Oest <i>et al.</i>	(JADE Collab.)
ALDE	87	PL B198 286	D.M. Alde <i>et al.</i>	(LANL, BRUX, SERP, LAPP)
AUGUSTIN	87	ZPHY C36 369	J.E. Augustin <i>et al.</i>	(LALO, CLER, FRAS+)
BALTRUSAIT...	87	PR D35 2077	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i>	(BELG, LAPP, SERP, CERN+)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
BINON	84B	LNC 39 41	F.G. Binon <i>et al.</i>	(SERP, BELG, LAPP)
BINON	83C	SJNP 38 723	F.G. Binon <i>et al.</i>	(SERP, BRUX+)
		Translated from YAF 38 1199.		
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i>	(IOWA, MICH)
CASON	82	PRL 48 1316	N.M. Cason <i>et al.</i>	(NDAM, ANL)
ETKIN	82B	PR D25 1786	A. Etkin <i>et al.</i>	(BNL, CUNY, TUFTS, VAND)
ALPER	80	PL 94B 422	B. Alper <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
ROZANSKA	80	NP B162 505	M. Rozanska <i>et al.</i>	(MPIM, CERN)
CORDEN	79	NP B157 250	M.J. Corden <i>et al.</i>	(BIRM, RHEL, TELA+)
EVANGELIS...	79B	NP B154 381	C. Evangelista <i>et al.</i>	(BARI, BONN, CERN+)
ANTIPOV	77	NP B119 45	Y.M. Antipov <i>et al.</i>	(SERP, GEVA)
APEL	75	PL 57B 398	W.D. Apel <i>et al.</i>	(KARLK, KARLE, PISA, SERP+)
BLUM	75	PL 57B 403	W. Blum <i>et al.</i>	(CERN, MPIM) JP

REFID=52719

REFID=52761

REFID=51574

REFID=50780

REFID=47432

REFID=47950

REFID=47962

REFID=46605

REFID=46914

REFID=46373

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REFID=41358

REFID=40221

REFID=40268

REFID=40010

REFID=20765

REFID=21349

REFID=21780

REFID=40288

REFID=20754

REFID=20746

REFID=20390

REFID=21665

REFID=21774

REFID=20374

REFID=21967

REFID=20728

REFID=20720

REFID=21651

$\pi_2(2100)$

$I^G(J^{PC}) = 1^-(2^-+)$

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M020

NODE=M020

NODE=M020M

NODE=M020M

NODE=M020M;LINKAGE=AX
NODE=M020M;LINKAGE=L

NODE=M020W

NODE=M020W

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

$\pi_2(2100)$ 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	
625± 50 OUR AVERAGE	Error includes scale factor of 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)	
Γ_1 3π	seen	
Γ_2 $\rho\pi$	seen	
Γ_3 $f_2(1270)\pi$	seen	
Γ_4 $(\pi\pi)_S\pi$	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+)

$f_0(2100)$

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

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

2086⁺²⁰₋₂₄ OUR AVERAGE

2081±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. ● ● ●					
2090±10±6	529	^{2,3} DOBBS	15		$J/\psi \rightarrow \gamma\pi^+\pi^-$
2099±17±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

284⁺⁶⁰₋₃₂ OUR AVERAGE

273 ⁺²⁷ ₋₂₄ ⁺⁷⁰ ₋₂₃	5.5k	⁶ 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. ● ● ●					
236±14	80k	⁷ UMAN	06	E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$
211±29		⁸ 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	$\bar{p}p \rightarrow \pi\pi$

⁶ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

⁷ Statistical error only.

⁸ 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

DOBBS	15	PR D91 052006	S. Dobbs <i>et al.</i>	(NWES)
ABLIKIM	13N	PR D87 092009	Ablikim M. <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=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.

$K\bar{K}$ MODE

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2200 ± 13	VLADIMIRSK...06	SPEC	$40 \pi^- p \rightarrow K_S^0 K_S^0 n$
2150 ± 20	ABLIKIM	04E BES2	$J/\psi \rightarrow \omega K^+ K^-$
2130 ± 35	BARBERIS	99 OMEG	$450 p p \rightarrow p_s p_f K^+ K^-$

NODE=M042M5
NODE=M042M5

 $f_2(2150)$ WIDTH

NODE=M042210

 $f_2(2150)$ WIDTH, COMBINED MODES (MeV)

152 $\pm$ 30 OUR AVERAGE Includes data from the datablock that follows this one. Error includes scale factor of 1.4. See the ideogram below.

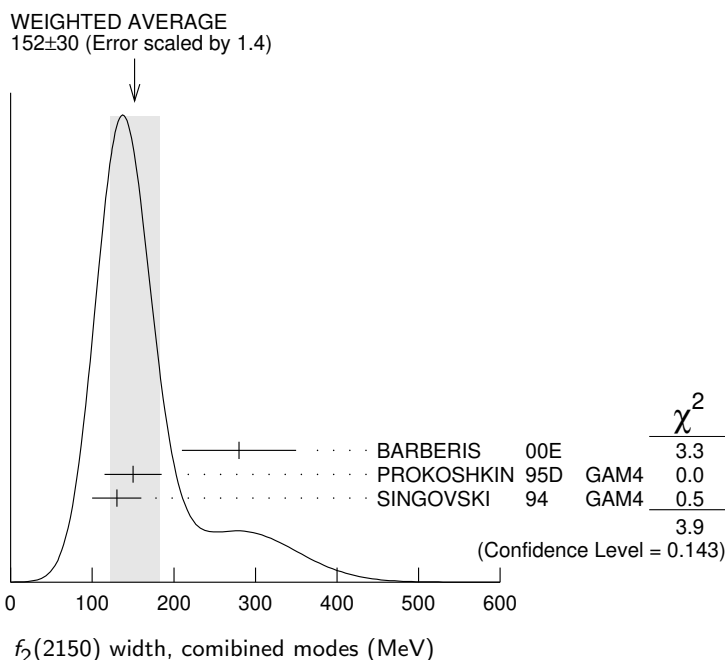
NODE=M042W
NODE=M042W

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

182 ± 11	80k	¹² UMAN	06	E835	$5.2 \bar{p} p \rightarrow \eta \eta \pi^0$

¹² Statistical error only.

NODE=M042W;LINKAGE=ST

 **$\eta\eta$ MODE**

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M042W3
NODE=M042W3

The data in this block is included in the average printed for a previous datablock.

152 $\pm$ 30 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.

280 ± 70	BARBERIS	00E	$450 p p \rightarrow p_f \eta \eta p_s$
150 ± 35	PROKOSHKIN 95D	GAM4	$300 \pi^- N \rightarrow \pi^- N 2\eta,$ $450 p p \rightarrow p p 2\eta$
130 ± 30	SINGOVSKI 94	GAM4	$450 p p \rightarrow p p 2\eta$

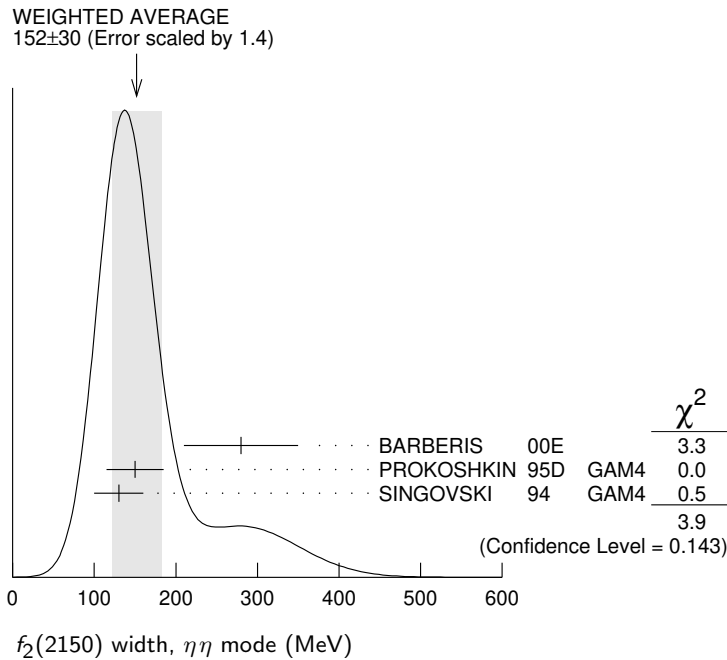
• • • We do not use the following data for averages, fits, limits, etc. • • •

310 ± 50	¹³ ABELE	99B	CBAR	$1.94 \bar{p} p \rightarrow \pi^0 \eta \eta$
203 ± 10	¹⁴ ARMSTRONG	93C	E760	$\bar{p} p \rightarrow \pi^0 \eta \eta \rightarrow 6\gamma$

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 $p\bar{p} \rightarrow p_f \eta \eta p_s$

• • • 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 $p\bar{p} \rightarrow p p 2\eta$

²² Using data from ARMSTRONG 89D.

NODE=M042220

NODE=M042R1
NODE=M042R1

$\Gamma(\pi\pi)/\Gamma(\eta\eta)$					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 $p\bar{p} \rightarrow p p 2\eta$

²³ Derived from a $\pi^0\pi^0/\eta\eta$ limit.

NODE=M042R1;LINKAGE=A

NODE=M042R2
NODE=M042R2

$\Gamma(f_2(1270)\eta)/\Gamma(a_2(1320)\pi)$	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=M042R2;LINKAGE=A

NODE=M042R3
NODE=M042R3

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$					Γ_6/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	73	ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$	

NODE=M042R3;LINKAGE=A

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. Vladimirsky <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=51191REFID=50174
REFID=47945
REFID=47961
REFID=46904
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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 our mini-review under the $\rho(1700)$.

NODE=M032

NODE=M032

 $\rho(2150)$ MASS

NODE=M032205

 e^+e^- PRODUCED

NODE=M032M3

NODE=M032M3

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2255 $^{+17}_{-18}$ $^{+50}_{-41}$	1.8k	¹ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
2201 ± 19		² LEES	20 BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
2227 ± 9 ± 9		³ LEES	20 RVUE	$e^+ e^- \rightarrow K^+ K^-$
2039 ± 8 $^{+36}_{-18}$		⁴ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
2239.2 $\pm 7.1 \pm 11.3$		⁵ ABLIKIM	19L BES3	$e^+ e^- \rightarrow K^+ K^-$
2254 ± 22		⁶ 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		⁷ CLEGG	90 RVUE	$e^+ e^- \rightarrow 3(\pi^+ \pi^-)$, $2(\pi^+ \pi^- \pi^0)$

OCCUR=2

OCCUR=2

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (21.7 \pm 1.9^{+7.7}_{-8.3}) \times 10^{-6}$.

NODE=M032M3;LINKAGE=F

² 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 .

NODE=M032M3;LINKAGE=C

³ 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.

NODE=M032M3;LINKAGE=D

⁴ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X \pi^0 \rightarrow K^+ K^- \pi^0 = (6.7 \pm 1.1^{+2.2}_{-1.8}) \times 10^{-6}$.

NODE=M032M3;LINKAGE=B

⁵ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

NODE=M032M3;LINKAGE=E

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.

NODE=M032M3;LINKAGE=LE

⁷ Includes ATKINSON 85.

NODE=M032M3;LINKAGE=A

 $\bar{p}p \rightarrow \pi\pi$

NODE=M032M1

NODE=M032M1

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	0.36–1.55 $\bar{p}p \rightarrow \pi\pi$
~ 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.

NODE=M032M1;LINKAGE=CC

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

NODE=M032M;LINKAGE=P

S-CHANNEL $\bar{N}N$

NODE=M032M2

NODE=M032M2

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.

NODE=M032M;LINKAGE=AY

² Isospins 0 and 1 not separated.

³ From a fit to the total elastic cross section.

⁴ Referred to as T or $\bar{T}$ 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=M032M;LINKAGE=I

NODE=M032M;LINKAGE=E

NODE=M032M;LINKAGE=M

NODE=M032M;LINKAGE=B

$\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2140 ± 30	ALDE	95	GAM2 $38 \pi^- p \rightarrow \omega \pi^0 n$
2170 ± 30	ALDE	92C	GAM4 $100 \pi^- p \rightarrow \omega \pi^0 n$

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. • • •				
$460 \pm 54 \pm 160$ $-48 -90$	1.8k	¹ ABLIKIM	20F BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
70 ± 38		² LEES	20 BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
$127 \pm 14 \pm 4$		³ LEES	20 RVUE	$e^+ e^- \rightarrow K^+ K^-$
$196 \pm 23 \pm 25$ -27		⁴ ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
$139.8 \pm 12.3 \pm 20.6$		⁵ ABLIKIM	19L BES3	$e^+ e^- \rightarrow K^+ K^-$
109 ± 76		⁶ LEES	12G BABR	$e^+ e^- \rightarrow \pi^+ \pi^- \gamma$
$350 \pm 40 \pm 50$		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		⁷ CLEGG	90 RVUE	$e^+ e^- \rightarrow 3(\pi^+ \pi^-), 2(\pi^+ \pi^- \pi^0)$

NODE=M032W3
 NODE=M032W3

OCCUR=2

OCCUR=2

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (21.7 \pm 1.9^{+7.7}_{-8.3}) \times 10^{-6}$.

NODE=M032W3;LINKAGE=F

² 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 .

NODE=M032W3;LINKAGE=C

³ 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.

NODE=M032W3;LINKAGE=D

⁴ Could also be another state. Seen in J/ψ decay with branching ratio $J/\psi \rightarrow X \pi^0 \rightarrow K^+ K^- \pi^0 = (6.7 \pm 1.1^{+2.2}_{-1.8}) \times 10^{-6}$.

NODE=M032W3;LINKAGE=B

⁵ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

NODE=M032W3;LINKAGE=E

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.

NODE=M032W3;LINKAGE=LE

⁷ Includes ATKINSON 85.

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

NODE=M032W1
 NODE=M032W1

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.

NODE=M032W1;LINKAGE=CC

² $I(J^P) = 1(1^-)$ from simultaneous analysis of $p \bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

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 $\bar{p} N$

NODE=M032W2
 NODE=M032W2

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M032W;LINKAGE=AY

² From a fit to the total elastic cross section.

NODE=M032W;LINKAGE=E

³ Isospins 0 and 1 not separated.

NODE=M032W;LINKAGE=I

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=M032W;LINKAGE=B

$\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
320 ± 70	ALDE	95	GAM2 38 $\pi^- p \rightarrow \omega \pi^0 n$
~ 300	ALDE	92C	GAM4 100 $\pi^- p \rightarrow \omega \pi^0 n$

NODE=M032W4
 NODE=M032W4

 $\rho(2150)$ DECAY MODES

NODE=M032215;NODE=M032

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} $p \bar{p}$	

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=10

 $\rho(2150) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$

NODE=M032230

$\Gamma(f_1(1285)\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	$\Gamma_7/\Gamma \times \Gamma_1/\Gamma$		
<u>VALUE (units 10^{-7})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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=M032G01
 NODE=M032G01

NODE=M032G01;LINKAGE=AU

$\Gamma(\eta' \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$	$\Gamma_6 / \Gamma \times \Gamma_1 / \Gamma$		
<u>VALUE (units 10^{-8})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
• • • 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

NODE=M032

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	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	

REFID=60256
 REFID=60211
 REFID=59909
 REFID=59612
 REFID=55404
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 REFID=41894
 REFID=41355
 REFID=22000
 REFID=21838
 REFID=21837
 REFID=21733
 REFID=21830
 REFID=21824
 REFID=21813
 REFID=21807
 REFID=21805
 REFID=48054

$\phi(2170)$

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

NODE=M103

 $\phi(2170)$ MASS

NODE=M103M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2153 ±25 OUR AVERAGE		Error includes scale factor of 1.8. [2188 ± 10 MeV OUR 2018 AVERAGE Scale factor = 1.8]		
2177.5 ± 4.8 ± 19.5		¹ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta' \phi$
2126.5 ± 16.8 ± 12.4		² ABLIKIM	20S BES3	$e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2135 ± 8 ± 9	95	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta \phi f_0(980)$
2239.2 ± 7.1 ± 11.3		³ 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		^{4,5} LEES	12F BABR	10.6 $e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
2079 ± 13 $^{+79}_{-28}$	4.8k	⁶ 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	⁷ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
2169 ± 20	149	⁷ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
2175 ± 10 ± 15	201	^{5,8} AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi \pi \gamma$

NODE=M103M

NEW

OCCUR=2

NODE=M103M;LINKAGE=D

NODE=M103M;LINKAGE=E

NODE=M103M;LINKAGE=C

NODE=M103M;LINKAGE=A

NODE=M103M;LINKAGE=AB

NODE=M103M;LINKAGE=SH

NODE=M103M;LINKAGE=AU

NODE=M103M;LINKAGE=B

¹ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

² 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.

³ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.

⁴ Fit includes interference with the $\phi(1680)$.

⁵ From the $\phi f_0(980)$ component.

⁶ From a fit with two incoherent Breit-Wigners.

⁷ From the $K^+ K^- f_0(980)$ component.

⁸ Superseded by LEES 12F.

 $\phi(2170)$ WIDTH

NODE=M103W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
143 ±17 OUR AVERAGE		[83 ± 12 MeV OUR 2018 AVERAGE]		
149.0 ± 15.6 ± 8.9		¹ ABLIKIM	20M BES3	$e^+e^- \rightarrow \eta' \phi$
106.9 ± 32.1 ± 28.1		² ABLIKIM	20S BES3	$e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
104 ± 24 ± 12	95	ABLIKIM	19I BES3	$e^+e^- \rightarrow \eta \phi f_0(980)$
139.8 ± 12.3 ± 20.6		³ 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		^{4,5} LEES	12F BABR	10.6 $e^+e^- \rightarrow \phi \pi^+ \pi^- \gamma$
192 ± 23 $^{+25}_{-61}$	4.8k	⁶ 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	⁷ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
102 ± 27	149	⁷ AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi^0 \pi^0 \gamma$
58 ± 16 ± 20	201	^{5,8} AUBERT,BE	06D BABR	10.6 $e^+e^- \rightarrow K^+ K^- \pi \pi \gamma$

NODE=M103W

NEW

OCCUR=2

- ¹ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.
- ² 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.
- ³ The observed structure can be due to both the $\phi(2170)$ and $\rho(2150)$.
- ⁴ Fit includes interference with the $\phi(1680)$.
- ⁵ From the $\phi f_0(980)$ component.
- ⁶ From a fit with two incoherent Breit-Wigners.
- ⁷ From the $K^+ K^- f_0(980)$ component.
- ⁸ Superseded by LEES 12F.

NODE=M103W;LINKAGE=D

NODE=M103W;LINKAGE=E

NODE=M103W;LINKAGE=C

NODE=M103W;LINKAGE=A

NODE=M103W;LINKAGE=AB

NODE=M103W;LINKAGE=SH

NODE=M103W;LINKAGE=AU

NODE=M103W;LINKAGE=B

NODE=M103215;NODE=M103

 $\phi(2170)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	seen
Γ_2 $\phi\eta$	
Γ_3 $\phi\eta'$	
Γ_4 $\phi\pi\pi$	
Γ_5 $\phi f_0(980)$	seen
Γ_6 $K^+ K^- \pi^+ \pi^-$	
Γ_7 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-$	seen
Γ_8 $K^+ K^- \pi^0 \pi^0$	
Γ_9 $K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen
Γ_{10} $K^{*0} K^\pm \pi^\mp$	not seen
Γ_{11} $K^*(892)^0 \bar{K}^*(892)^0$	not seen
Γ_{12} $K^*(892)^+ K^*(892)^-$	
Γ_{13} $K(1460)^+ K^- + \text{c.c.}$	
Γ_{14} $K_1(1270)^+ K^- + \text{c.c.}$	
Γ_{15} $K_1(1400)^+ K^- + \text{c.c.}$	

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=5

DESIG=11

DESIG=9

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3

DESIG=6

DESIG=4

DESIG=7

DESIG=8

DESIG=10

DESIG=15

DESIG=12

DESIG=14

DESIG=13

 $\phi(2170) \Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

NODE=M103230

$\Gamma(\phi\eta) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	

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

1.7±0.7±1.3 483 AUBERT 08S BABR 10.6 $e^+ e^- \rightarrow \phi\eta\gamma$

$\Gamma(\phi\eta') \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV) DOCUMENT ID TECN COMMENT	

7.1±0.7±0.7 ¹ ABLIKIM 20M BES3 $e^+ e^- \rightarrow \eta' \phi$

¹ From a fit using a coherent sum of a phase-space modified Breit-Wigner function and a phase-space term.

NODE=M103R00

NODE=M103R00

NODE=M103R00;LINKAGE=A

$\Gamma(\phi f_0(980)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_5\Gamma_1/\Gamma$
VALUE (eV) EVTS DOCUMENT ID TECN COMMENT	

2.3±0.3±0.3 ^{1,2} LEES 12F BABR 10.6 $e^+ e^- \rightarrow \phi\pi^+ \pi^- \gamma$

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

2.5±0.8±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.

² From the $\phi f_0(980)$ component.

³ Superseded by LEES 12F.

NODE=M103G1

NODE=M103G1

NODE=M103G1;LINKAGE=A

NODE=M103G1;LINKAGE=AB

NODE=M103G1;LINKAGE=B

$\Gamma(K^*(892)^+ K^*(892)^-) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$	$\Gamma_{12}\Gamma_1/\Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	

<1.9 90 ¹ ABLIKIM 20S BES3 $e^+ e^- \rightarrow K^+ K^- \pi^0 \pi^0$

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

NODE=M103R08

NODE=M103R08;LINKAGE=A

$$\Gamma(K(1460)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{13} \Gamma_1 / \Gamma$$

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

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
NODE=M103R05

NODE=M103R05;LINKAGE=A

$$\Gamma(K_1(1270)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{14} \Gamma_1 / \Gamma$$

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

$$\Gamma(K_1(1400)^+ K^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{15} \Gamma_1 / \Gamma$$

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

$$\phi(2170) \Gamma(i) \Gamma(e^+ e^-) / \Gamma^2(\text{total})$$

NODE=M103220

$$\Gamma(\phi \pi \pi) / \Gamma_{\text{total}} \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma \times \Gamma_1 / \Gamma$$

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

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	AUBERT	07AK	BABR 10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$

NODE=M103R01
NODE=M103R01

$$\Gamma(K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_9 / \Gamma$$

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

$$\Gamma(K^{*0} K^\pm \pi^\mp) / \Gamma_{\text{total}} \quad \Gamma_{10} / \Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT

not seen	AUBERT	07AK	BABR 10.6 GeV $e^+ e^-$

NODE=M103R03
NODE=M103R03

$$\Gamma(K^{*}(892)^0 \bar{K}^{*}(892)^0) / \Gamma_{\text{total}} \quad \Gamma_{11} / \Gamma$$

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

NODE=M103

ABLIKIM	20M	PR D102 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60337
ABLIKIM	20S	PRL 124 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60542
ABLIKIM	19I	PR D99 012014	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59605
ABLIKIM	19L	PR D99 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59612
ABLIKIM	15H	PR D91 052017	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56773
LEES	12F	PR D86 012008	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54298
ABLIKIM	10C	PL B685 27	M. Ablikim <i>et al.</i>	(BES II Collab.)	REFID=53349
SHEN	09	PR D80 031101	C.P. Shen <i>et al.</i>	(BELLE Collab.)	REFID=53000
ABLIKIM	08F	PRL 100 102003	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52154
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511

$f_0(2200)$

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

NODE=M112

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 $\Upsilon(1S)$ radiative decays (BARU 89).

NODE=M112

 $f_0(2200)$ MASS

NODE=M112M

VALUE (MeV)	EVT5	DOCUMENT ID	TECN	COMMENT
2187±14 OUR AVERAGE				
2170±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. • • •				
2206±12± 8	381	^{2,3} DOBBS	15	$J/\psi \rightarrow \gamma K^+ K^-$
2188±17±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	$\bar{p} p \rightarrow \pi \pi$
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

OCCUR=2

OCCUR=2

NODE=M112M;LINKAGE=A
 NODE=M112M;LINKAGE=B
 NODE=M112M;LINKAGE=C
 NODE=M112M;LINKAGE=BI

 $f_0(2200)$ WIDTH

NODE=M112W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
207±40 OUR AVERAGE			
220±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. • • •			
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	$\bar{p} p \rightarrow \pi \pi$
⁵ Cannot determine spin to be 0.			
⁶ First solution, PWA is ambiguous.			

NODE=M112W

OCCUR=2

NODE=M112W;LINKAGE=A
 NODE=M112W;LINKAGE=BI

 $f_0(2200)$ REFERENCES

NODE=M112

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>	
		Translated from YAF 68 998.		
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.)

REFID=56805
 REFID=50958
 REFID=50780
 REFID=44103
 REFID=40917
 REFID=40574

$f_J(2220)$

$$J^G(J^{PC}) = 0^+(2^{++} \text{ or } 4^{++})$$

OMITTED FROM SUMMARY TABLE

Needs confirmation. See our mini-review in the 2004 edition of this Review, PDG 04.

NODE=M082

NODE=M082

 $f_J(2220)$ MASS

NODE=M082M

NODE=M082M

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				

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

NODE=M082M;LINKAGE=A
NODE=M082M;LINKAGE=VL $f_J(2220)$ WIDTH

NODE=M082W

NODE=M082W

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					

OCCUR=2

NODE=M082W;LINKAGE=VL

 $f_J(2220)$ DECAY MODES

NODE=M082215;NODE=M082

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

DESIG=5

DESIG=6;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=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	$\gamma\gamma \rightarrow K_S^0 K_S^0, E_{\text{cm}}^{\text{ee}} = 91, 183-209 \text{ GeV}$

• • • 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	$1.4-1.5 p\bar{p} \rightarrow \pi^0 \pi^0$

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

< (11-42)	99	² HASAN	96 SPEC	$1.35-1.55 p\bar{p} \rightarrow \pi^+ \pi^-$

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	$1.1-2.0 p\bar{p} \rightarrow \phi\phi$

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	$1.4-1.5 p\bar{p} \rightarrow \eta\eta$

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	$1.96-2.40 p\bar{p} \rightarrow K_S^0 K_S^0$
< 1.1	99.7	³ BARNES	93 SPEC	$1.3-1.57 p\bar{p} \rightarrow K_S^0 K_S^0$
< 2.6	99.7	³ BARDIN	87 CNTR	$1.3-1.5 p\bar{p} \rightarrow K^+ K^-$
< 3.6	99.7	³ SCULLI	87 CNTR	$1.29-1.55 p\bar{p} \rightarrow K^+ K^-$

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. Vladimirovsky <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=52681REFID=51990
REFID=50651
REFID=49653
REFID=48321
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REFID=45197
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REFID=41374
REFID=40585
REFID=40580
REFID=47474REFID=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=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

NODE=M115M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

• • • 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 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).

OCCUR=2

NODE=M115M;LINKAGE=B

 $\eta(2225)$ WIDTH

NODE=M115W

NODE=M115W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 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

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.)

NODE=M115

REFID=57512
REFID=16595
REFID=52255
REFID=41354
REFID=22101

NODE=M044

$\rho_3(2250)$

$$I^G(J^{PC}) = 1^{+}(3^{-}-)$$

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

• • • 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 $\psi(2S) \rightarrow X\eta \rightarrow K^{+} K^{-} \eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

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.

³ $I(J^P) = 1(3^{-})$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^{-}\pi^{+}$ and $\pi^0\pi^0$.

⁴ $I = 0, 1$. $J^P = 3^{-}$ from Barrelet-zero analysis.

⁵ $I(J^P) = 1(3^{-})$ from amplitude analysis.

NODE=M044M1
NODE=M044M1

NODE=M044M1;LINKAGE=A

NODE=M044M1;LINKAGE=CC

NODE=M044M1;LINKAGE=P
NODE=M044M1;LINKAGE=K
NODE=M044M1;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. • • •

2260 ± 20	⁶ ANISOVICH	02	SPEC	$0.6\text{--}1.9 \bar{p}\bar{p} \rightarrow \omega\pi^0$, $\omega\eta\pi^0, \pi^{+}\pi^{-}$
~ 2190	⁷ CUTTS	78B	CNTR	$0.97\text{--}3 \bar{p}\bar{p} \rightarrow \bar{N}N$
2155 ± 15	^{7,8} COUPLAND	77	CNTR 0	$0.7\text{--}2.4 \bar{p}\bar{p} \rightarrow \bar{p}p$
2193 ± 2	^{7,9} ALSPECTOR	73	CNTR	$\bar{p}\bar{p}$ 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 $\bar{T}$ 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.

NODE=M044M;LINKAGE=AY

NODE=M044M2;LINKAGE=I
NODE=M044M2;LINKAGE=E
NODE=M044M2;LINKAGE=M
NODE=M044M2;LINKAGE=B

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=M044M3
NODE=M044M3

$\rho_3(2250)$ WIDTH

NODE=M044210

$\bar{p}p \rightarrow \pi\pi$ or $K\bar{K}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$185^{+31}_{-26} +^{17}_{-103}$	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	$0.36\text{--}1.55 \bar{p}p \rightarrow \pi\pi$
~ 250		13 MARTIN	80B	RVUE	
~ 200		13 MARTIN	80C	RVUE	
~ 150		14 CARTER	78B	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow K^- K^+$
~ 200		15 CARTER	77	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow \pi\pi$

¹¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X\eta \rightarrow K^+ K^- \eta = (1.9 \pm 0.4^{+0.5}_{-1.3}) \times 10^{-6}$.

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.

¹³ $I(J^P) = 1(3^-)$ from simultaneous analysis of $p\bar{p} \rightarrow \pi^- \pi^+$ and $\pi^0 \pi^0$.

¹⁴ $I = 0, 1$. $J^P = 3^-$ from Barrelet-zero analysis.

¹⁵ $I(J^P) = 1(3^-)$ from amplitude analysis.

NODE=M044W1
NODE=M044W1

NODE=M044W1;LINKAGE=A

NODE=M044W1;LINKAGE=CC

NODE=M044W1;LINKAGE=P
NODE=M044W1;LINKAGE=K
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	$0.6\text{--}1.9 \bar{p}p \rightarrow \omega \pi^0, \omega \eta \pi^0, \pi^+ \pi^-$
135 ± 75	17,18 COUPLAND	77	CNTR 0	$0.7\text{--}2.4 \bar{p}p \rightarrow \bar{p}p$
98 ± 8	18 ALSPECTOR	73	CNTR	$\bar{p}p$ S channel
~ 85	19 ABRAMS	70	CNTR	S channel $\bar{p}N$

¹⁶ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

¹⁷ From a fit to the total elastic cross section.

¹⁸ Isospins 0 and 1 not separated.

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
NODE=M044W2

NODE=M044W;LINKAGE=AY

NODE=M044W2;LINKAGE=E
NODE=M044W2;LINKAGE=I
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
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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. • • •			
2243 ⁺⁷ ₋₆ ⁺³ ₋₂₉	² 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 $\pi^- Be \rightarrow 2\phi Be$
2220 ⁺⁹⁰ ₋₂₀	LINDENBAUM	84	RVUE
2320±40	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 6⁺¹⁵₋₅, 25⁺¹⁸₋₁₄, and 69⁺¹⁶₋₂₇, respectively.

² Spin 2 preferred, tentatively assigned to $f_2(2300)$.

NODE=M107M

NODE=M107M;LINKAGE=C

NODE=M107M;LINKAGE=A

 $f_2(2300)$ WIDTH

NODE=M107W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
149±41	³ ETKIN	88	MPS 22 $\pi^- p \rightarrow \phi \phi n$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
145±12 ⁺²⁷ ₋₃₄	⁴ 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 $\pi^- Be \rightarrow 2\phi Be$
200±50	LINDENBAUM	84	RVUE
220±70	ETKIN	82	MPS 22 $\pi^- p \rightarrow 2\phi n$

³ Includes data of ETKIN 85.

⁴ Spin 2 preferred, tentatively assigned to $f_2(2300)$.

NODE=M107W

NODE=M107W;LINKAGE=C

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

DESIG=1;OUR EST;→ UNCHECKED ←

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=3;OUR EST;→ UNCHECKED ←

 $f_2(2300)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M107225

$$\frac{\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)}{\Gamma_{\text{total}}} \quad \Gamma_2\Gamma_3/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
3.2 ^{+0.5} _{-0.4} ^{+1.3} _{-2.2}	UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$
44 ±6 ±12	⁵ ABE	04	BELL 10.6 $e^+ e^- \rightarrow e^+ e^- K^+ K^-$

⁵ Assuming spin 2.

NODE=M107G1

NODE=M107G1

NODE=M107G1;LINKAGE=AB

 $f_2(2300)$ REFERENCES

NODE=M107

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)
		Translated from YAF 69 515.		
ABE	04	EPJ C32 323	K. Abe <i>et al.</i>	(BELLE Collab.)
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)
ETKIN	82	PRL 49 1620	A. Etkin <i>et al.</i>	(BNL, CUNY)

REFID=55592

REFID=51191

REFID=49650

REFID=40285

REFID=21870

REFID=21871

REFID=21869

REFID=21866

$f_4(2300)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

NODE=M041

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

NODE=M041M

 $\bar{p}p \rightarrow \pi\pi$ 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 $p\bar{p} \rightarrow \pi^- \pi^+$ 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
NODE=M041M1NODE=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		

NODE=M041M4
NODE=M041M4

→ UNCHECKED ←

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

2332 ± 15	BARBERIS	00F	450 $pp \rightarrow p_f \omega \omega p_S$

 $f_4(2300)$ WIDTH

NODE=M041210

 $\bar{p}p \rightarrow \pi\pi$ 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=M041W1
NODE=M041W1NODE=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
• • • 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

$\Gamma(\rho\rho)/\Gamma(\omega\omega)$				Γ_1/Γ_2
VALUE	DOCUMENT ID	COMMENT		
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.8 ± 0.5	BARBERIS	00F 450 $pp \rightarrow p_f\omega\omega p_s$		

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

 $f_0(2330)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2314 ± 25	¹ BUGG	04A	RVUE
2337 ± 14	ANISOVICH	00J	SPEC $2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 2321	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
¹ Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.			

NODE=M169M

NODE=M169M

NODE=M169M;LINKAGE=BU

 $f_0(2330)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
144 ± 20	² BUGG	04A	RVUE
217 ± 33	ANISOVICH	00J	SPEC $2.0 \bar{p} p \rightarrow \pi \pi, \eta \eta$
~ 223	HASAN	94	RVUE $\bar{p} p \rightarrow \pi \pi$
² Partial wave analysis of the data on $p \bar{p} \rightarrow \bar{\Lambda} \Lambda$ from BARNES 00.			

NODE=M169W

NODE=M169W

NODE=M169W;LINKAGE=BU

 $f_0(2330)$ REFERENCES

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=50158
REFID=47950
REFID=47965
REFID=44103

NODE=M108

 $f_2(2340)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 $f_2(2340)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2345^{+50}_{-40} OUR AVERAGE				
$2362^{+31+140}_{-30-63}$	5.5k	¹ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
2339 ± 55		² 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	³ 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
¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.				
² 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.				
³ Statistical error only.				

NODE=M108M

NODE=M108M

NODE=M108M;LINKAGE=A

NODE=M108M;LINKAGE=C

NODE=M108M;LINKAGE=ST

 $f_2(2340)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
322^{+70}_{-60} OUR AVERAGE				
$334^{+62+165}_{-54-100}$	5.5k	⁴ ABLIKIM	13N	BES3 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \eta \eta$
319^{+81}_{-69}		⁵ 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	⁶ 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

NODE=M108W

⁴ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.
⁵ Includes data of ETKIN 85.
⁶ Statistical error only.

NODE=M108W;LINKAGE=A

NODE=M108W;LINKAGE=C
NODE=M108W;LINKAGE=ST

NODE=M108215;NODE=M108

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

NODE=M108220

NODE=M108R01
NODE=M108R01

NODE=M108

REFID=55387
REFID=51063
REFID=40285
REFID=21870
REFID=21871
REFID=21869

NODE=M033

NODE=M033

NODE=M033205

NODE=M033M

NODE=M033M3
NODE=M033M3

NODE=M033M1
NODE=M033M1

NODE=M033M2
NODE=M033M2

$f_2(2340)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \phi\phi$	seen
$\Gamma_2 \quad \eta\eta$	seen

$f_2(2340)$ BRANCHING RATIOS

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$				Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	UMAN	06	E835	$5.2 \bar{p}p \rightarrow \eta\eta\pi^0$

$f_2(2340)$ REFERENCES

ABLIKIM	13N	PR D87 092009	Ablikim M. <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)

$\rho_5(2350)$

$I^G(J^{PC}) = 1^+(5^{--})$

OMITTED FROM SUMMARY TABLE
This entry was previously called $U_1(2400)$. See also $\rho(2150)$,
 $f_2(2150)$, $\rho_3(2250)$, $f_4(2300)$.

$\rho_5(2350)$ MASS

$\pi^- p \rightarrow \omega \pi^0 n$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2330 ± 35	ALDE	95	GAM2 $38 \pi^- p \rightarrow \omega \pi^0 n$

$\bar{p}p \rightarrow \pi\pi$ or $\bar{K}K$

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
~ 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 $\bar{N}N$

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 **$\pi^- p \rightarrow \omega \pi^0 n$**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
400 ± 100	ALDE	95	GAM2	38 $\pi^- p \rightarrow \omega \pi^0 n$

NODE=M033210

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 ⁺ ₄₀ ⁶⁵	ANISOVICH	00J	SPEC	
135 ⁺ ₆₅ ¹⁵⁰	14,15 COUPLAND	77	CNTR	0 0.7-2.4 $\bar{p}p \rightarrow \bar{p}p$
165 ⁺ ₈ ¹⁸	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

ρ₅(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
REFID=21837
REFID=21964
REFID=21733
REFID=21963
REFID=21830
REFID=21813
REFID=21931
REFID=21926
REFID=21807
REFID=21925
REFID=21804

NODE=M247

X(2370)

$I^G(J^{PC}) = ?^?(?^{??})$

OMITTED FROM SUMMARY TABLE

X(2370) MASS

NODE=M247M

NODE=M247M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2341.6±6.5±5.7		¹ ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K \bar{K} \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2376.3 \pm 8.7^{+3.2}_{-4.3}$	565	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
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

NODE=M247W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
117±10± 8	¹ ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K \bar{K} \eta'$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$83 \pm 17^{+44}_{-6}$	ABLIKIM	11C BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
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)
$\Gamma_1 \quad K^+ K^- \eta'$	seen
$\Gamma_2 \quad K_S^0 K_S^0 \eta'$	seen
$\Gamma_3 \quad \pi^+ \pi^- \eta'$	seen

DESIG=1

DESIG=2

DESIG=3

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	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$
$\Gamma(\pi^+ \pi^- \eta')/\Gamma_{\text{total}}$				Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ABLIKIM	11C	BES3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$

NODE=M247R01
NODE=M247R01

NODE=M247R02
NODE=M247R02

NODE=M247R00
NODE=M247R00

X(2370) REFERENCES

NODE=M247

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.)

REFID=60457
REFID=53684

$f_6(2510)$

$I^G(J^{PC}) = 0^+(6^{++})$

NODE=M089

OMITTED FROM SUMMARY TABLE
Needs confirmation.

NODE=M089

$f_6(2510)$ MASS

NODE=M089M

NODE=M089M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2465±50 OUR AVERAGE Error includes scale factor of 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.			

NODE=M089M;LINKAGE=AN

$f_6(2510)$ WIDTH

NODE=M089W

NODE=M089W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
255±40 OUR 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.			

NODE=M089W;LINKAGE=AN

$f_6(2510)$ DECAY MODES

NODE=M089215;NODE=M089

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi \pi$	(6.0±1.0) %

DESIG=1

$f_6(2510)$ BRANCHING RATIOS

NODE=M089220

NODE=M089R1
NODE=M089R1

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
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.				

NODE=M089R1;LINKAGE=A

$f_6(2510)$ REFERENCES

NODE=M089

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)

REFID=47942
REFID=47950
REFID=46903
REFID=46926
REFID=47416
REFID=47472
REFID=46605
REFID=46914

REFID=21780
REFID=40288

REFID=44705

OTHER LIGHT MESONS

Further States

OMITTED FROM SUMMARY TABLE

This section contains states observed by a single group or states poorly established that thus need confirmation.

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	$2.75 d C \rightarrow \gamma \gamma X$

¹ Not seen in $p C \rightarrow \gamma \gamma X$ at 5.5 GeV/c.

NODE=MXXX015

NODE=M300

NODE=M300

NODE=M300K08
NODE=M300K08

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		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

¹ Supersedes GRIGOR'EV 05.

NODE=M300J07
NODE=M300J07

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

f₀(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 $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\pi^+ \pi^- \rightarrow \pi^+ \pi^-$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \pi^0 \eta$, $\pi^0 \pi^0 \eta$, $\pi^+ \pi^- \pi^0$, $K^+ K^- \pi^0$, $K_S^0 K_S^0 \pi^0$, $K^+ K_S^0 \pi^-$ 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=M300;LINKAGE=KM

² K-matrix pole from combined analysis of $\pi^- p \rightarrow \pi^0 \pi^0 n$, $\pi^- p \rightarrow K \bar{K} n$, $\bar{p} p \rightarrow \pi^0 \pi^0 \pi^0$, $\pi^0 \pi^0 \eta$, $\pi^0 \pi^0 \eta$ at rest.

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		$40 \pi^- p \rightarrow K_S^0 K_S^0 n + m\pi^0$

¹ Supersedes VLADIMIRSKII 00.

NODE=M300K07
NODE=M300K07

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) $J^G(J^{PC}) = 2^+(2^{++})$					
<u>MASS (MeV)</u>	<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
1600±100	400 ± 200	¹ ALBRECHT 91F ARG	10.2	$e^+ e^- \rightarrow e^+ e^- 2(\pi^+ \pi^-)$	
¹ Our estimate.					

NODE=M300J99
NODE=M300J99

NODE=M300J99;LINKAGE=A

X(1650) $J^G(J^{PC}) = 0^-(?^{-})$					
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) $J^G(J^{PC}) = ?^?(?^{?+})$					
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

X(1750)						$J^G(J^{PC}) = ?^?(1^{- -})$		
<u>MASS (MeV)</u>			<u>WIDTH (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
1784	± 12	$\pm \begin{smallmatrix} 0 \\ -27 \end{smallmatrix}$	$106 \pm \begin{smallmatrix} 22 & 8 \\ -19 & -36 \end{smallmatrix}$	¹ ABLIKIM 20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$		
1753.5	± 1.5	± 2.3	$122.2 \pm 6.2 \pm 8.0$	LINK	02K FOCS	20–160 $\gamma p \rightarrow K^+ K^- p$		
¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow X \eta \rightarrow K^+ K^- \eta = (4.8 \pm 1.0 \pm 2.6) \times 10^{-6}$.								

NODE=M300J94
NODE=M300J94

NODE=M300J94;LINKAGE=A

B(X(1750) → $\bar{K}^*(892)^0 K^0 \rightarrow K^\pm \pi^\mp K_S^0$)/B(X(1750) → $K^+ K^-$)				
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	
<0.065	90	LINK	02k	FOCS

B(X(1750) → $K^*(892)^\pm K^\mp \rightarrow K_S^0 \pi^\pm K^\mp$)/B(X(1750) → $K^+ K^-$)				
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	
<0.183	90	LINK	02k	FOCS

NODE=M300B5
NODE=M300B5NODE=M300B6
NODE=M300B6

f₂(1750) $J^G(J^{PC}) = 0^+(2^{++})$					
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

Γ(ηη)					
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.0±0.5	870	² SCHEGELSKY 06A	RVUE	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M300JA4
NODE=M300JA4

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=M300JAM;LINKAGE=SC
NODE=M300JA;LINKAGE=SC

X(1775) $J^G(J^{PC}) = 1^-(?^{- +})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1763±20	192 ± 60	CONDO 91	SHF	$\gamma p \rightarrow (p \pi^+)(\pi^+ \pi^- \pi^-)$	

NODE=M300J60
NODE=M300J60

1787 ± 18 118 ± 60 CONDO 91 SHF $\gamma p \rightarrow n\pi^+\pi^+\pi^-$

OCCUR=2

$f_0(1800)$	$I^G(J^{PC}) = 0^+(0^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1795 ± 7 ⁺²³ ₋₂₀	95 ± 10 ⁺⁷⁸ ₋₈₂	ABLIKIM	13J	BES3	$J/\psi \rightarrow \gamma\omega\phi$
1812 ⁺¹⁹ ₋₂₆ ± 18	105 ± 20 ± 28	¹ ABLIKIM	06J	BES2	$J/\psi \rightarrow \gamma\omega\phi$

¹ Not seen by LIU 09 in $B^\pm \rightarrow K^\pm\omega\phi$.

NODE=M300K29
NODE=M300K29

NODE=M300K29;LINKAGE=AB

$X(1850 - 3100)$	$I^G(J^{PC}) = ?^?(1^{--})$				
$\Gamma(e^+e^-) \cdot B(X \rightarrow \text{hadrons})$ (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

$X(1855)$	$I^G(J^{PC}) = ?^?(??)$				
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

$X(1870)$	$I^G(J^{PC}) = ?^?(2^{??})$				
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

$a_3(1875)$	$I^G(J^{PC}) = 1^-(3^{++})$				
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

$a_1(1930)$	$I^G(J^{PC}) = 1^-(1^{++})$				
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

$X(1935)$	$I^G(J^{PC}) = 1^+(1^{-?})$				
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

$\rho_2(1940)$	$I^G(J^{PC}) = 1^+(2^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
1940 ± 40	155 ± 40	¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J85
NODE=M300J85

¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J85;LINKAGE=AY

$\omega_3(1945)$	$I^G(J^{PC}) = 0^-(3^{--})$				
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

$h_3(2030) \quad I^G(J^{PC}) = 1^+(3^{+-})$					
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

$X(2075)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2075 ± 12 ± 5	90 ± 35 ± 9	¹ ABLIKIM	04J	BES2	$J/\psi \rightarrow K^- p\bar{\Lambda}$

NODE=M300J01
NODE=M300J01

¹ From a fit in the region $M_{p\bar{\Lambda}} - M_p - M_{\Lambda} < 150$ 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=AB

$X(2080)$ $I^G(J^{PC}) = ??(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	110 ± 20	KREYMER	80	STRC	13 $\pi^- d \rightarrow p\bar{p}n(n_s)$

NODE=M300J35
NODE=M300J35

X(2080)	$I^G(J^{PC}) = ?^?(3^{-?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2080 ± 10	190 ± 15	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J37
NODE=M300J37

a₁(2095)	$I^G(J^{PC}) = 1^-(1^{++})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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))					
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
3.18 ± 0.64	69k	KUHN	04	B852	18 $\pi^- p \rightarrow \eta \pi^+ \pi^- \pi^- p$

NODE=M300B03
NODE=M300B03

η(2100)	$I^G(J^{PC}) = 0^+(0^{-+})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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)	$I^G(J^{PC}) = ?^?(0^{??})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2100 ± 40	250 ± 40	ALDE	86D	GAM4	100 $\pi^- p \rightarrow 2\eta X$

NODE=M300J49
NODE=M300J49

X(2110)	$I^G(J^{PC}) = 1^+(3^{-?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2110 ± 10	330 ± 20	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p} p n$

NODE=M300J36
NODE=M300J36

f₂(2140)	$I^G(J^{PC}) = 0^+(2^{++})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2141 ± 12	49 ± 28	389	GREEN	86	MPSF 400 $pA \rightarrow 4K X$

NODE=M300J50
NODE=M300J50

X(2150)	$I^G(J^{PC}) = ?^?(2^{+?})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2150 ± 10	260 ± 10	ROZANSKA	80	SPRK	18 $\pi^- p \rightarrow p \bar{p} n$

NODE=M300J38
NODE=M300J38

a₂(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

η(2190)	$I^G(J^{PC}) = 0^+(0^{-+})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2190 ± 50	850 ± 100	BUGG	99	BES	

NODE=M300J13
NODE=M300J13

ω₂(2195)	$I^G(J^{PC}) = 0^-(2^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2195 ± 30	225 ± 40	1 ANISOVICH	02B	SPEC	0.6–1.9 $p \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J82
NODE=M300J82

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J82;LINKAGE=AZ

ω(2205)	$I^G(J^{PC}) = 0^-(1^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2205 ± 30	350 ± 90	1 ANISOVICH	02B	SPEC	0.6–1.9 $p \bar{p} \rightarrow \omega \eta, \omega \pi^0 \pi^0$

NODE=M300J80
NODE=M300J80

¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J80;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 $\pi^- p \rightarrow K^+ K^- n$

NODE=M300J39
NODE=M300J39

X(2210) $I^G(J^{PC}) = ?^?(???)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2207 ± 22	130	CASO	70	HBC	11.2 $\pi^- p$

NODE=M300J51
NODE=M300J51

h₁(2215) $I^G(J^{PC}) = 0^-(1^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2215 ± 40	325 ± 55	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J27
NODE=M300J27¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J27;LINKAGE=AZ

ρ₂(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 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J70
NODE=M300J70¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J70;LINKAGE=AY

ρ₄(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 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J74
NODE=M300J74¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J74;LINKAGE=AY

b₁(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 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$

NODE=M300J87
NODE=M300J87¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300J87;LINKAGE=AY

f₂(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 $p\bar{p}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 2226	~ 226	HASAN	94	RVUE	$p\bar{p} \rightarrow \pi\pi$

NODE=M300K26
NODE=M300K26¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99F, ANISOVICH 99J, ANISOVICH 99K, and ANISOVICH 00B. See also ANISOVICH 12.

NODE=M300K26;LINKAGE=AN

b₃(2245) $I^G(J^{PC}) = 1^+(3^+ -)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2245 ± 50	320 ± 70	¹ BUGG	04C	RVUE	

NODE=M300K10
NODE=M300K10¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.

NODE=M300K10;LINKAGE=AY

η₂(2250) $I^G(J^{PC}) = 0^+(2^- +)$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2248 ± 20	280 ± 20	ANISOVICH	00I	SPEC	
2267 ± 14	290 ± 50	ANISOVICH	00J	SPEC	

NODE=M300J17
NODE=M300J17

$\pi_4(2250) \quad I^G(J^{PC}) = 1^-(4^-+)$					
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

$\omega_4(2250) \quad I^G(J^{PC}) = 0^-(4^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 30	150 ± 50	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J84
NODE=M300J84

NODE=M300J84;LINKAGE=AZ

$\omega_5(2250) \quad I^G(J^{PC}) = 0^-(5^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2250 ± 70	320 ± 95	¹ BUGG	04	RVUE	
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300K11
NODE=M300K11

NODE=M300;LINKAGE=AZ

$\omega_3(2255) \quad I^G(J^{PC}) = 0^-(3^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 15	175 ± 30	¹ ANISOVICH	02B	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$
¹ From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.					

NODE=M300J66
NODE=M300J66

NODE=M300J66;LINKAGE=AZ

$a_4(2255) \quad I^G(J^{PC}) = 1^-(4^{++})$					
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 $\bar{p}p$
¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, and ANISOVICH 01F.					

NODE=M300K21
NODE=M300K21

NODE=M300K21;LINKAGE=AN

$a_2(2255) \quad I^G(J^{PC}) = 1^-(2^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2255 ± 20	230 ± 15	¹ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$
¹ From the combined analysis of ANISOVICH 99C, ANISOVICH 99E, ANISOVICH 01F, and ANISOVICH 01G.					

NODE=M300K22
NODE=M300K22

NODE=M300K22;LINKAGE=AN

$X(2260) \quad I^G(J^{PC}) = 0^+(4^{+?})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2260 ± 20	400 ± 100	EVANGELIS...	79	OMEG	10,16 $\pi^- p \rightarrow \bar{p}pn$

NODE=M300J40
NODE=M300J40

$\rho(2270) \quad I^G(J^{PC}) = 1^+(1^{--})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2265 ± 40	325 ± 80	¹ ANISOVICH	02	SPEC	0.6–1.9 $p\bar{p} \rightarrow \omega\pi^0, \omega\eta\pi^0, \pi^+\pi^-$
2280 ± 50	440 ± 110	ATKINSON	85	OMEG	20–70 $\gamma p \rightarrow p\omega\pi^+\pi^-\pi^0$
¹ From the combined analysis of ANISOVICH 00J, ANISOVICH 01D, ANISOVICH 01E, and ANISOVICH 02.					

NODE=M300J86
NODE=M300J86

NODE=M300J86;LINKAGE=AY

$a_1(2270) \quad I^G(J^{PC}) = 1^-(1^{++})$					
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

$h_3(2275) \quad I^G(J^{PC}) = 0^-(3^{+-})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 25	190 ± 45	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=M300J28
NODE=M300J28

NODE=M300J28;LINKAGE=AZ

$a_3(2275) \quad I^G(J^{PC}) = 1^-(3^{++})$					
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
2275 ± 35	350 ⁺¹⁰⁰ ₋₅₀	¹ ANISOVICH	01G	SPEC	1.96–2.41 $\bar{p}p$

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 ± 20 ± 25	250 ± 20 ± 25	¹ ANISOVICH	11	SPEC	0.9–1.94 $p\bar{p}$

NODE=M300K25
NODE=M300K25

¹ Reanalysis of ADOMEIT 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	0.6–1.9 $p\bar{p} \rightarrow \omega\eta, \omega\pi^0\pi^0$

NODE=M300J83
NODE=M300J83

¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

² From the combined analysis of ANISOVICH 00D, ANISOVICH 01C, and ANISOVICH 02B.

NODE=M300J83;LINKAGE=BU
NODE=M300J83;LINKAGE=AZ

$\omega(2290)$ $I^G(J^{PC}) = 0^-(1^{--})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
2290 ± 20	275 ± 35	¹ BUGG	04A	RVUE

NODE=M300J02
NODE=M300J02

¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ 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	1.92–2.41 $p\bar{p}$

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	
2334 ± 25	200 ± 20	¹ BUGG	04A	RVUE

NODE=M300J19
NODE=M300J19

¹ Partial wave analysis of the data on $p\bar{p} \rightarrow \bar{\Lambda}\Lambda$ from BARNES 00.

NODE=M300J19;LINKAGE=BU

$f_1(2310)$ $I^G(J^{PC}) = 0^+(1^{++})$				
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	
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	
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 $\pi^+ p \rightarrow p5\pi$

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

$X(2440)$ $I^G(J^{PC}) = ?^?(5^{-?})$					
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

$X(2632)$ $I^G(J^{PC}) = ?^?(??)$					
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	$X(2632) \rightarrow D_s^0 K^+$	

NODE=M300J03
NODE=M300J03

OCCUR=2

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;LINKAGE=EV
NODE=M300J03;LINKAGE=ED

$B(X(2632) \rightarrow D_s^0 K^+)/B(X(2632) \rightarrow D_s^+ \eta)$					
VALUE	DOCUMENT ID	TECN			
0.14 ± 0.06	¹ EVDOKIMOV	04 SELX			

NODE=M300B01
NODE=M300B01

¹ Possible interpretation of this decay pattern is discussed by YASUI 07.

NODE=M300B01;LINKAGE=YA

$X(2680)$ $I^G(J^{PC}) = ?^?(??)$					
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

$X(2710)$ $I^G(J^{PC}) = ?^?(6^{+?})$					
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

$X(2750)$ $I^G(J^{PC}) = ?^?(7^{-?})$					
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

$f_6(3100)$	$I^G(J^{PC}) = 0^+(6^{++})$				
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

$X(3250)$	$I^G(J^{PC}) = ?^?(?^{??})$	3-Body Decays			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3250 ± 8 ± 20	45 ± 18	ALEEV	93	BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+$
3265 ± 7 ± 20	40 ± 18	ALEEV	93	BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^-$

NODE=M300J57
NODE=M300J57

OCCUR=2

$X(3250)$	$I^G(J^{PC}) = ?^?(?^{??})$	4-Body Decays			
MASS (MeV)	WIDTH (MeV)	DOCUMENT ID	TECN	COMMENT	
3245 ± 8 ± 20	25 ± 11	ALEEV	93	BIS2	$X(3250) \rightarrow \Lambda \bar{p} K^+ \pi^\pm$
3250 ± 9 ± 20	50 ± 20	ALEEV	93	BIS2	$X(3250) \rightarrow \bar{\Lambda} p K^- \pi^\mp$
3270 ± 8 ± 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

$X(3350)$	$I^G(J^{PC}) = ?^?(?^{??})$				
MASS (MeV)	WIDTH (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$3350^{+10}_{-20} \pm 20$	$70^{+40}_{-30} \pm 40$	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

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UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
ANISOVICH	12	PR D85 014001	A.V. Anisovich <i>et al.</i>	
ANASHIN	11	PL B703 543	V.V. Anashin <i>et al.</i>	(KEDR Collab.)
ANISOVICH	11	EPJ C71 1511	A.V. Anisovich <i>et al.</i>	(LOQM, RAL, PNPI)
CHEN	11F	PR D84 071501	P. Chen <i>et al.</i>	(BELLE Collab.)
AUBERT	10H	PR D82 031102	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABRAAMYAN	09	PR C80 034001	Kh.U. Abraamyan <i>et al.</i>	
LIU	09	PR D79 071102	C. Liu <i>et al.</i>	(BELLE Collab.)
VLADIMIRSK...	08	PAN 71 2129	V.V. Vladimirsky <i>et al.</i>	(ITEP)
VLADIMIRSK...	07	Translated from YAF 71 2166. PAN 70 1706	V. Vladimirsky <i>et al.</i>	
YASUI	07	PR D76 034009	S. Yasui, M. Oka	
ABLIKIM	06J	PRL 96 162002	M. Ablikim <i>et al.</i>	(BES Collab.)
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SCHEGELSKY	06	EPJ A27 199	V.A. Schegelsky <i>et al.</i>	
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UMAN	06	PR D73 052009	I. Uman <i>et al.</i>	(FNAL E835)
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BINON	05	Translated from YAF 69 515. PAN 68 960	F. Binon <i>et al.</i>	
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BUGG	04	PL B595 556 (errat.)	D.V. Bugg	
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ANISOVICH	02B	PL B542 19	A.V. Anisovich <i>et al.</i>	
CHUNG	02	PR D65 072001	S.U. Chung <i>et al.</i>	(BNL E852 Collab.)
LINK	02K	PL B545 50	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ANISOVICH	01C	PL B507 23	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	01F	PL B517 261	A.V. Anisovich <i>et al.</i>	
ANISOVICH	01G	PL B517 273	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00B	NP A662 319	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00D	PL B476 15	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00E	PL B477 19	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00I	PL B491 40	A.V. Anisovich <i>et al.</i>	
ANISOVICH	00J	PL B491 47	A.V. Anisovich <i>et al.</i>	(RAL, LOQM, PNPI+)
ANISOVICH	00M	PL B496 145	A.V. Anisovich <i>et al.</i>	
BARNES	00	PR C62 055203	P.D. Barnes <i>et al.</i>	
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		Translated from ZETFP 72 698.		

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		Translated from YAF 56 100	
ARMSTRONG	93D	PL B307 399	T.A. Armstrong <i>et al.</i> (FNAL, FERR, GENO+)
ALBRECHT	91F	ZPHY C50 1	H. Albrecht <i>et al.</i> (ARGUS Collab.)
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BISELLO	89B	PR D39 701	G. Busetto <i>et al.</i> (DM2 Collab.)
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DAFTARI	87	PRL 58 859	I.K. Daftari <i>et al.</i> (SYRA)
ALDE	86D	NP B269 485	D.M. Alde <i>et al.</i> (BELG, LAPP, SERP, CERN+)
BRIDGES	86D	PL B180 313	D.L. Bridges <i>et al.</i> (SYRA, BNL, CASE+)
GREEN	86	PRL 56 1639	D.R. Green <i>et al.</i> (FNAL, ARIZ, FSU+)
ATKINSON	85	ZPHY C29 333	M. Atkinson <i>et al.</i> (BONN, CERN, GLAS+)
DENNEY	83	PR D28 2726	D.L. Denney <i>et al.</i> (IOWA, MICH)
CLELAND	82B	NP B208 228	W.E. Cleland <i>et al.</i> (DURH, GEVA, LAUS+)
ASTON	81B	NP B189 205	D. Aston <i>et al.</i> (BONN, CERN, EPOL, GLAS+)
ARESTOV	80	IHEP 80-165	Y.I. Arestov <i>et al.</i> (SERP)
CHLIAPNIK...	80	ZPHY C3 285	P.V. Chliapnikov <i>et al.</i> (SERP, BRUX, MONS)
KREYMER	80	PR D22 36	A.E. Kreymer <i>et al.</i> (IND, PURD, SLAC+)
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STRANGE MESONS

$$(S = \pm 1, C = B = 0)$$

$$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s, \text{ similarly for } K^{*'}s$$

NODE=MXXX020

NODE=MXXX020

NODE=M174

$K_0^*(700)$

$$I(J^P) = \frac{1}{2}(0^+)$$

also known as κ ; was $K_0^*(800)$

See the review on "Scalar Mesons below 2 GeV."

NODE=M174

$K_0^*(700)$ T-Matrix Pole $\sqrt{s}$

NODE=M174TMP

NODE=M174TMP

→ UNCHECKED ←

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
(630-730) – i (260-340) OUR EVALUATION			
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(648 \pm 7) - i(280 \pm 16)$	¹ PELAEZ	20	RVUE $\pi K \rightarrow \pi K$
$(670 \pm 18) - i(295 \pm 28)$	² PELAEZ	17	RVUE $\pi K \rightarrow \pi K$
$(764 \pm 63 \pm_{-54}^{+71}) - i(306 \pm 149 \pm_{-85}^{+143})$	³ ABLIKIM	11B	BES2 $1.3k J/\psi \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$
$(665 \pm 9) - i(268 \pm_{-6}^{+21})$	⁴ GUO	11B	RVUE
$(849 \pm 77 \pm_{-14}^{+18}) - i(256 \pm 40 \pm_{-22}^{+46})$	³ ABLIKIM	10E	BES2 $1.4k J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
$(663 \pm 8 \pm 34) - i(329 \pm 5 \pm 22)$	⁵ BUGG	10	RVUE S-matrix pole
$(706.0 \pm 1.8 \pm 22.8) - i(319.4 \pm 2.2 \pm 20.2)$	⁶ BONVICINI	08A	CLEO $141k D^+ \rightarrow K^- \pi^+ \pi^+$
$(841 \pm 30 \pm_{-73}^{+81}) - i(309 \pm 45 \pm_{-72}^{+48})$	³ ABLIKIM	06C	BES2 $25k J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$
$(750 \pm_{-55}^{+30}) - i(342 \pm 60)$	⁷ BUGG	06	RVUE
$(658 \pm 13) - i(279 \pm 12)$	⁸ DESCOTES-G.	06	RVUE $\pi K \rightarrow \pi K$
$(757 \pm 33) - i(279 \pm 41)$	⁹ GUO	06	RVUE
$(694 \pm 53) - i(303 \pm 30)$	¹⁰ ZHOU	06	RVUE $K p \rightarrow K^- \pi^+ n$
$(594 \pm 79) - i(362 \pm 166)$	¹⁰ ZHENG	04	RVUE $K^- p \rightarrow K^- \pi^+ n$
$(722 \pm 60) - i(386 \pm 50)$	¹⁰ BUGG	03	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$(875 \pm 75) - i(335 \pm 110)$	¹¹ ISHIDA	97B	RVUE $11 K^- p \rightarrow K^- \pi^+ n$
$727 - i 263$	¹² VANBEVEREN	86	RVUE

- 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 Extracted from Breit-Wigner parameters.
- ⁴ Fit to scattering phase shifts using UChPT amplitudes with explicit resonances.
- ⁵ 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.
- ⁶ From a complex pole included in the fit. Using parameters from the model that fits data best.
- ⁷ Reanalysis of ASTON 88, AITALA 02, and ABLIKIM 06C using for the κ an s -dependent width with an Adler zero near threshold.
- ⁸ Using Roy-Steiner equations (ROY 71) consistent with unitarity, analyticity and crossing symmetry constraints.
- ⁹ From UChPT fitted to MERCER 71, BINGHAM 72 and ESTABROOKS 78. Amplitude shown to be consistent with data of ABLIKIM 06C.
- ¹⁰ Reanalysis of ASTON 88 data.
- ¹¹ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes. Extracted from Breit-Wigner parameters.
- ¹² Unitarized Quark Model.

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
824 ± 30 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	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
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	$D^+ \rightarrow K^- \pi^+ \pi^+$
856 ± 17 ± 13	54k	⁷ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
855 ± 15	0.6k	⁸ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
905 $^{+65}_{-30}$		⁹ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

NODE=M174M
 NODE=M174M

OCCUR=2

OCCUR=2

OCCUR=2

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.

NODE=M174M;LINKAGE=LI

² From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M174M;LINKAGE=BL

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.

NODE=M174M;LINKAGE=EP

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 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

NODE=M174M;LINKAGE=A

⁵ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

NODE=M174M;LINKAGE=AU

⁶ Using parameters from the model that fits data best.

NODE=M174M;LINKAGE=C
 NODE=M174M;LINKAGE=BW
 NODE=M174M;LINKAGE=CA

⁷ A Breit-Wigner mass and width.

⁸ Breit-Wigner parameters. A significant S -wave can be also modeled as a non-resonant contribution.

⁹ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

NODE=M174M;LINKAGE=IS

 $K_0^*(700)$ Breit-Wigner Width

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
478 ± 50 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	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$
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	$D^+ \rightarrow K^- \pi^+ \pi^+$

NODE=M174W

NODE=M174W

OCCUR=2

OCCUR=2

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

550.4 ± 11.8	141k	⁶ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
464 ± 28 ± 22	54k	⁷ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
251 ± 48	0.6k	⁸ CAWLFIELD	06A CLEO	$D^0 \rightarrow K^+ K^- \pi^0$
545 $\begin{smallmatrix} +235 \\ -110 \end{smallmatrix}$		⁹ ISHIDA	97B RVUE	$11 K^- p \rightarrow K^- \pi^+ n$

OCCUR=2

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.

NODE=M174W;LINKAGE=LI

² From a fit including ten additional resonances and energy-independent Breit-Wigner width.

NODE=M174W;LINKAGE=BL

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.

NODE=M174W;LINKAGE=EP

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 $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$.

NODE=M174W;LINKAGE=A

⁵ AUBERT 07T does not find evidence for the charged $K_0^*(700)$ using 11k events of $D^0 \rightarrow K^- K^+ \pi^0$.

NODE=M174W;LINKAGE=AU

⁶ Using parameters from the model that fits data best.

NODE=M174W;LINKAGE=C

⁷ A Breit-Wigner mass and width.

NODE=M174W;LINKAGE=BW

⁸ 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.

NODE=M174W;LINKAGE=CA

⁹ Reanalysis of ASTON 88 using interfering Breit-Wigner amplitudes.

NODE=M174W;LINKAGE=IS

$K_0^*(700)$ DECAY MODES

NODE=M174215;NODE=M174

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K \pi$	100 %

DESIG=1;OUR EVAL;→ UNCHECKED ←

$K_0^*(700)$ REFERENCES

NODE=M174

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>
GUO	11B	PR D84 034005	Z.-H. Guo, J.A. Oller
ABLIKIM	10E	PL B693 88	M. Ablikim <i>et al.</i>
BUGG	10	PR D81 014002	D.V. Bugg
LINK	09	PL B681 14	J.M. Link <i>et al.</i>
BONVICINI	08A	PR D78 052001	G. Bonvicini <i>et al.</i>
AUBERT	07T	PR D76 011102	B. Aubert <i>et al.</i>
EPIFANOV	07	PL B654 65	D. Epifanov <i>et al.</i>
LINK	07B	PL B653 1	J.M. Link <i>et al.</i>
ABLIKIM	06C	PL B633 681	M. Ablikim <i>et al.</i>
AITALA	06	PR D73 032004	E.M. Aitala <i>et al.</i>
Also		PR D74 059901 (errata.)	E.M. Aitala <i>et al.</i>
BUGG	06	PL B632 471	D.V. Bugg
CAWLFIELD	06A	PR D74 031108	C. Cawfield <i>et al.</i>
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>
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>
LINK	02E	PL B535 43	J.M. Link <i>et al.</i>
KOPP	01	PR D63 092001	S. Kopp <i>et al.</i>
ISHIDA	97B	PTP 98 621	S. Ishida <i>et al.</i>
ASTON	88	NP B296 493	D. Aston <i>et al.</i>
VANBEVEREN	86	ZPHY C30 615	E. van Beveren <i>et al.</i>
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>
BINGHAM	72	NP B41 1	H.H. Bingham <i>et al.</i>
MERCER	71	NP B32 381	R. Mercer <i>et al.</i>
ROY	71	PL 36B 353	S.M. Roy

REFID=60559
 REFID=57836
 REFID=53683
 REFID=58808
 REFID=53361
 REFID=53213
 REFID=53056
 REFID=52426
 REFID=51726
 REFID=51929
 REFID=51875
 REFID=51037
 REFID=51051
 REFID=51458
 REFID=50996
 REFID=51153
 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

NODE=M018TMP

(890 ± 14) – i (26 ± 6) OUR ESTIMATE

→ UNCHECKED ←

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

(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	$\pi K \rightarrow \pi K$

OCCUR=2

¹ Extracted employing πK partial wave analysis from ESTABROOKS 78 and ASTON 88, Roy-Steiner equations and once subtracted forward dispersion relations.

NODE=M018TMP;LINKAGE=A

² Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M018TMP;LINKAGE=E

³ Reanalysis of data from ESTABROOKS 78 and ASTON 88 in the unitarized ChPT model.

NODE=M018TMP;LINKAGE=B

 $K^*(892)$ MASS

NODE=M018205

CHARGED ONLY, HADROPRODUCED

NODE=M018M1

NODE=M018M1

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

891.67 ± 0.26 OUR AVERAGE

[891.66 ± 0.26 MeV OUR 2020 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 $\bar{p}p \rightarrow (K\pi)^\pm X$
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 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

OCCUR=2

• • • 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	DELFOSE	81	SPEC	50 $K^\pm p \rightarrow K^\pm \pi^0 p$
886.0 ± 2.3	187	DELFOSE	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=3

OCCUR=2

OCCUR=2

OCCUR=2

¹ Inclusive reaction. Complicated background and phase-space effects.

NODE=M018M;LINKAGE=I

² Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

NODE=M018M;LINKAGE=D

³ Number of events in peak reevaluated by us.

NODE=M018M;LINKAGE=W

⁴ From a Dalitz plot analysis in an isobar model with charged and neutral $K^*(892)$ masses and widths floating.

NODE=M018M1;LINKAGE=B

⁵ Average of fit results with different parametrizations for the $K\pi$ S-wave.

NODE=M018M1;LINKAGE=A

⁶ K-matrix pole.

NODE=M018M1;LINKAGE=AN

⁷ From a partial wave amplitude analysis.

NODE=M018M1;LINKAGE=F

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVS	DOCUMENT ID	TECN	COMMENT
895.47$\pm$0.20$\pm$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 $\pm$ 0.5		² BOITO	10 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
892.0 $\pm$ 0.9		^{3,4} BOITO	09 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
895.3 $\pm$ 0.2		^{4,5} JAMIN	08 RVUE	$\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
896.4 $\pm$ 0.9	12k	⁶ BONVICINI	02 CLEO	$\tau^- \rightarrow K^- \pi^0 \nu_\tau$
895 $\pm$ 2		⁷ 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 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
NODE=M018MCT

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)	EVS	DOCUMENT ID	TECN	COMMENT
895.55$\pm$0.20 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
894.68 $\pm$ 0.25 $\pm$ 0.05		¹ ABLIKIM	16F BES3	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.4 $\pm$ 0.2 $\pm$ 0.2	243k	² DEL-AMO-SA..11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
895.7 $\pm$ 0.2 $\pm$ 0.3	141k	³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
895.41 $\pm$ 0.32 $^{+0.35}_{-0.43}$	18k	⁴ LINK	05I FOCS	$D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
896 $\pm$ 2		BARBERIS	98E OMEG	450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
895.9 $\pm$ 0.5 $\pm$ 0.2		ASTON	88 LASS	11 $K^- p \rightarrow K^- \pi^+ n$
894.52 $\pm$ 0.63	25k	⁵ ATKINSON	86 OMEG	20-70 γp
894.63 $\pm$ 0.76	20k	⁵ ATKINSON	86 OMEG	20-70 γp
897 $\pm$ 1	28k	EVANGELIS...	80 OMEG	10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
898.4 $\pm$ 1.4	1180	AGUILAR-...	78B HBC	0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
894.9 $\pm$ 1.6		WICKLUND	78 ASPK	3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
897.6 $\pm$ 0.9		BOWLER	77 DBC	5.4 $K^+ d \rightarrow K^+ \pi^- p p$
895.5 $\pm$ 1.0	3600	MCCUBBIN	75 HBC	3.6 $K^- p \rightarrow K^- \pi^+ n$
897.1 $\pm$ 0.7	22k	⁵ PALER	75 HBC	14.3 $K^- p \rightarrow (K\pi)^0 X$
896.0 $\pm$ 0.6	10k	FOX	74 RVUE	2 $K^- p \rightarrow K^- \pi^+ n$
896.0 $\pm$ 0.6		FOX	74 RVUE	2 $K^+ n \rightarrow K^+ \pi^- p$
896 $\pm$ 2		⁶ MATISON	74 HBC	12 $K^+ p \rightarrow K^+ \pi^- \Delta$
896 $\pm$ 1	3186	LEWIS	73 HBC	2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
894.0 $\pm$ 1.3		⁶ LINGLIN	73 HBC	2-13 $K^+ p \rightarrow$ $K^+ \pi^- \pi^+ p$
898.4 $\pm$ 1.3	1700	⁷ BUCHNER	72 DBC	4.6 $K^+ n \rightarrow K^+ \pi^- p$
897.9 $\pm$ 1.1	2934	⁷ AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow K^- \pi^+ n$
898.0 $\pm$ 0.7	5362	⁷ AGUILAR-...	71B HBC	3.9,4.6 $K^- p \rightarrow$ $K^- \pi^+ \pi^- p$
895 $\pm$ 1	4300	⁸ HABER	70 DBC	3 $K^- N \rightarrow K^- \pi^+ X$
893.7 $\pm$ 2.0	10k	DAVIS	69 HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
894.7 $\pm$ 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 $\pm$ 0.92 $\pm$ 2.6		⁹ ADUSZKIEW...20A	NA61	158 pp
898.1 $\pm$ 1.0	4k	¹⁰ LEES	17C BABR	$J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
895.53 $\pm$ 0.17		LEES	13F BABR	$D^+ \rightarrow K^+ K^- \pi^+$
894.9 $\pm$ 0.5 $\pm$ 0.7	14.4k	¹¹ MITCHELL	09A CLEO	$D_s^+ \rightarrow K^+ K^- \pi^+$
896.2 $\pm$ 0.3	20k	¹² AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow$ $K^{*0} K^\pm \pi^\mp \gamma$
900.7 $\pm$ 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.

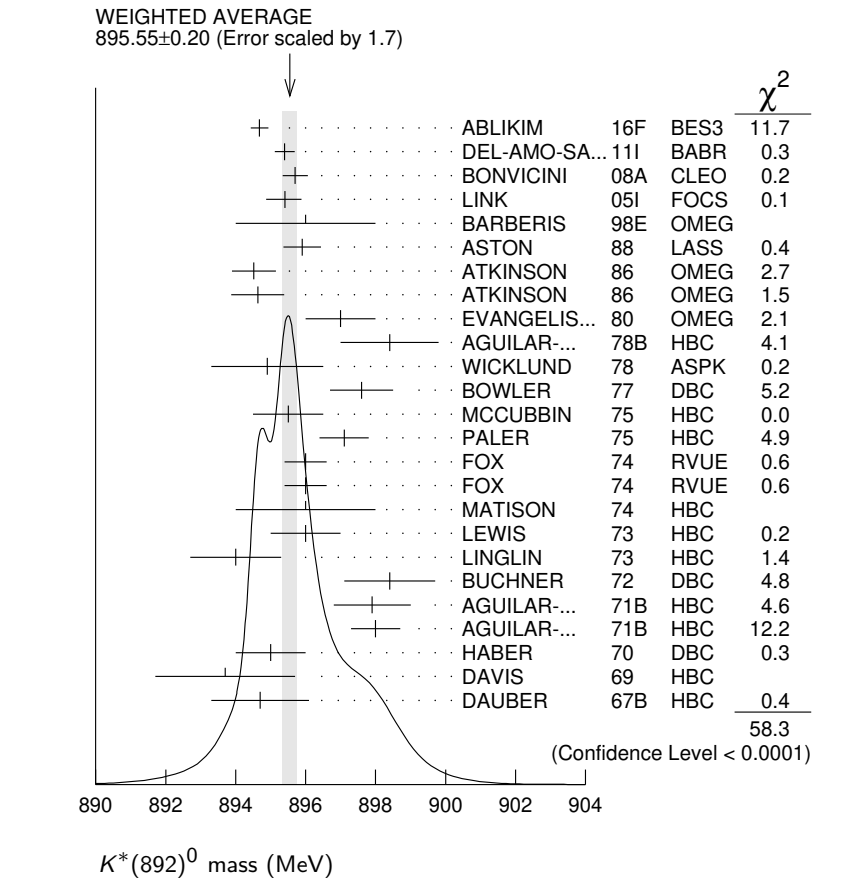
⁷ Mass errors enlarged by us to $\Gamma/\sqrt{N}$. See note.

NODE=M018M2;LINKAGE=B
NODE=M018M2;LINKAGE=DE
NODE=M018M2;LINKAGE=BO
NODE=M018M2;LINKAGE=LI
NODE=M018M2;LINKAGE=I
NODE=M018M2;LINKAGE=C
NODE=M018M2;LINKAGE=D

- 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=W
NODE=M018M2;LINKAGE=C
NODE=M018M2;LINKAGE=A

NODE=M018M2;LINKAGE=MI
NODE=M018M2;LINKAGE=NS



NODE=M018209

$K^*(892)$ 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.

$m_{K^*(892)^0} - m_{K^*(892)^\pm}$						
<i>VALUE</i> (MeV)	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>CHG</i>	<i>COMMENT</i>	
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 $\bar{p}p$

NODE=M018D

NODE=M018D

¹ Number of events in peak reevaluated by us.

NODE=M018D;LINKAGE=W

 $K^*(892)$ RANGE PARAMETER

All from partial wave amplitude analyses.

NODE=M018R

NODE=M018R

NODE=M018R

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
51.4 ±0.8 OUR FIT					
[50.8 ± 0.9 MeV OUR 2020 FIT]					
51.4 ±0.8 OUR AVERAGE					
[50.8 ± 0.9 MeV OUR 2020 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 $K^\pm p \rightarrow K^\pm \pi^0 p$

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=M018W1

NODE=M018W1

NEW

NEW

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=3

OCCUR=2

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NODE=M018W1;LINKAGE=A

NODE=M018W1;LINKAGE=AN

NODE=M018W1;LINKAGE=F

CHARGED ONLY, PRODUCED IN τ LEPTON DECAYS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.2$\pm$0.6$\pm$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 $\pm$ 1.1		² BOITO	10	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
46.2 $\pm$ 0.4		^{3,4} BOITO	09	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
47.5 $\pm$ 0.4		^{4,5} JAMIN	08	RVUE $\tau^- \rightarrow K_S^0 \pi^- \nu_\tau$
55 $\pm$ 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
NODE=M018W5

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 $\pm$0.5 OUR FIT				Error includes scale factor of 1.9.
47.3 $\pm$0.5 OUR AVERAGE				Error includes scale factor of 2.0. See the ideogram below.
46.53 $\pm$ 0.56 $\pm$ 0.31		¹ ABLIKIM	16F	BES3 $D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
46.5 $\pm$ 0.3 $\pm$ 0.2	243k	² DEL-AMO-SA...11I	BABR	$D^+ \rightarrow K^- \pi^+ e^+ \nu_e$
45.3 $\pm$ 0.5 $\pm$ 0.6	141k	³ BONVICINI	08A	CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
47.79 $\pm$ 0.86 $^{+1.32}_{-1.06}$	18k	⁴ LINK	05I	FOCS $D^+ \rightarrow K^- \pi^+ \mu^+ \nu_\mu$
54 $\pm$ 3		BARBERIS	98E	OMEG 450 $pp \rightarrow p_f p_s K^* \bar{K}^*$
50.8 $\pm$ 0.8 $\pm$ 0.9		ASTON	88	LASS 11 $K^- p \rightarrow K^- \pi^+ n$
46.5 $\pm$ 4.3	5900	BARTH	83	HBC 70 $K^+ p \rightarrow K^+ \pi^- X$
54 $\pm$ 2	28k	EVANGELIS...	80	OMEG 10 $\pi^- p \rightarrow K^+ \pi^- (\Lambda, \Sigma)$
45.9 $\pm$ 4.8	1180	AGUILAR-...	78B	HBC 0.76 $\bar{p} p \rightarrow K^\mp K_S^0 \pi^\pm$
51.2 $\pm$ 1.7		WICKLUND	78	ASPK 3,4,6 $K^\pm N \rightarrow (K\pi)^0 N$
48.9 $\pm$ 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 $\pm$ 2.5	22k	⁵ PALER	75	HBC 14.3 $K^- p \rightarrow (K\pi)^0 X$
47 $\pm$ 2	10k	FOX	74	RVUE 2 $K^- p \rightarrow K^- \pi^+ n$
51 $\pm$ 2		FOX	74	RVUE 2 $K^+ n \rightarrow K^+ \pi^- p$
46.0 $\pm$ 3.3	3186	⁶ LEWIS	73	HBC 2.1-2.7 $K^+ p \rightarrow K\pi\pi p$
51.4 $\pm$ 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 $\pm$ 2.7	5362	AGUILAR-...	71B	HBC 3.9,4.6 $K^- p \rightarrow K^- \pi^+ \pi^- p$
54.0 $\pm$ 3.3	4300	^{6,7} HABER	70	DBC 3 $K^- N \rightarrow K^- \pi^+ X$
53.2 $\pm$ 2.1	10k	⁶ DAVIS	69	HBC 12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$
44 $\pm$ 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 $\pm$ 1.8 $\pm$ 2.0		⁸ ADUSZKIEW...20A	NA61	158 pp
52.6 $\pm$ 1.7	4k	⁹ LEES	17C	BABR $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$
44.90 $\pm$ 0.30		LEES	13F	BABR $D^+ \rightarrow K^+ K^- \pi^+$
45.7 $\pm$ 1.1 $\pm$ 0.5	14.4k	¹⁰ MITCHELL	09A	CLEO $D_s^+ \rightarrow K^+ K^- \pi^+$
50.6 $\pm$ 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.

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NODE=M018W2

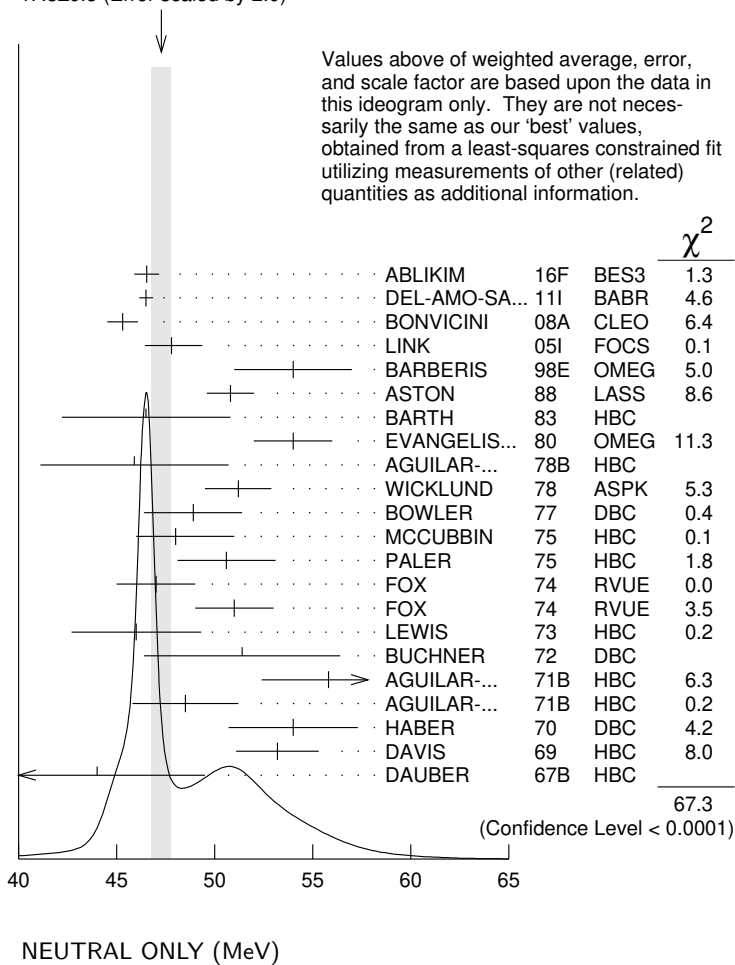
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OCCUR=2

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NODE=M018W2;LINKAGE=W
NODE=M018W2;LINKAGE=C
NODE=M018W2;LINKAGE=A

NODE=M018W2;LINKAGE=MI
NODE=M018W2;LINKAGE=NS

WEIGHTED AVERAGE
 47.3 ± 0.5 (Error scaled by 2.0)



$K^*(892)$ 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	-100
Γ	17 -17
	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	12	-12
	x_3	x_4

	Mode	Rate (MeV)	Scale factor
Γ_3	$(K\pi)^0$	47.2 ± 0.5	1.9
Γ_4	$K^0\gamma$	0.117 ± 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 ± 10 OUR FIT						
116.5 ± 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 ± 5 OUR FIT						
50 ± 5 OUR AVERAGE						
48 ± 11		BERG	83	SPEC	−	156 $K^- A \rightarrow \bar{K} \pi A$
51 ± 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 ± 0.21 OUR FIT						
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.5 ± 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 ± 0.09 OUR FIT						
[(0.99 ± 0.09) × 10^{-3} OUR 2020 FIT]						

NODE=M018R2
NODE=M018R2
NEW

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

<1.6	95	BEMPORAD	73	CNTR	+	10–16 $K^+ A$

$\Gamma(K\pi\pi)/\Gamma((K\pi)^\pm)$						Γ_6/Γ_2
VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT	
< 7 × 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 × 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.)	REFID=60631
ALBRECHT 20	EPJ C80 453	M. Albrecht <i>et al.</i>	(Crystal Barrel Collab.)	REFID=60439
PELAEZ 20	PRL 124 172001	J.R. Pelaez <i>et al.</i>		REFID=60559
ABLIKIM 19AQ	PR D100 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59909
LEES 17C	PR D95 072007	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=57981
PELAEZ 17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira		REFID=57836
AAIJ 16N	PR D93 052018	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57273
ABLIKIM 16F	PR D94 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57307
LEES 13F	PR D87 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=55127
DEL-AMO-SA... 11I	PR D83 072001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)	REFID=16493
ANTONELLI 10	EPJ C69 399	M. Antonelli <i>et al.</i>	(FlaviaNet Working Group)	REFID=53448
BOITO 10	JHEP 1009 031	D.R. Boito, R. Escribano, M. Jamin	(BARC)	REFID=53632
BOITO 09	EPJ C59 821	D.R. Boito, R. Escribano, M. Jamin		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	PR D17 658	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, NIJ+)	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, LIPV)	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

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

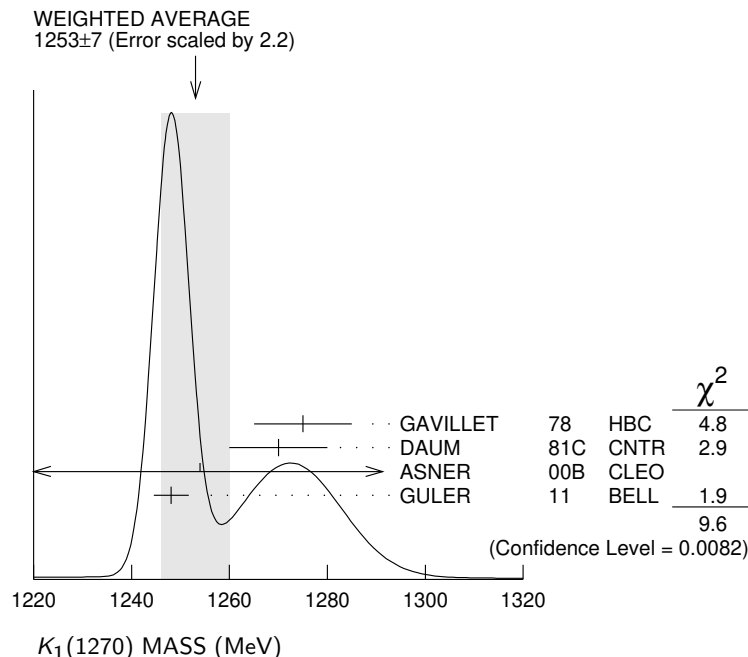
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 $K_1(1270)$ MASS

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 $K^+ d$

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 $\begin{smallmatrix} +9 \\ -10 \end{smallmatrix}$		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

1254 ± 33 ± 34	7k	ASNER	00B	CLEO	$\pm$	$\tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

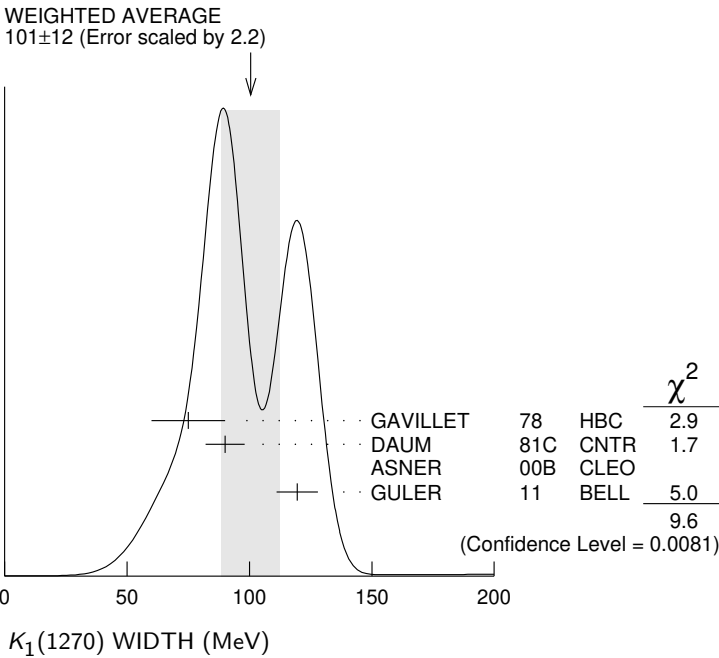
$K_1(1270)$ WIDTH

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 ± 6.7 GULER 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	18A1	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 ⁺⁷ / ₋₂₅		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 ⁺⁹⁰/₋₇₀ ± 80 7k ASNER 00B CLEO $\pm \tau^- \rightarrow K^- \pi^+ \pi^- \nu_\tau$

 $K_1(1270)$ DECAY MODES

NODE=M028215;NODE=M028

Mode	Fraction (Γ_i/Γ)
Γ_1 $K \rho$	(42 ± 6) %
Γ_2 $K_0^*(1430) \pi$	(28 ± 4) %
Γ_3 $K^*(892) \pi$	(16 ± 5) %
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±6.1±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

0.42 ±0.06

1

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 ±0.04

1

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

0.16 ±0.05

1

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 $\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE

DOCUMENT ID

TECN

COMMENT

0.11 ±0.02

1

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±0.02

1

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±0.7

1

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**

NODE=M028

AAIJ	18AI	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+) JP
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, LIPV) IJP
CRENNELL	67	PRL 19 44	D.J. Crennell <i>et al.</i>	(BNL) I

REFID=59187
REFID=53668
REFID=51623
REFID=51037
REFID=48822
REFID=47766
REFID=20573
REFID=22548
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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

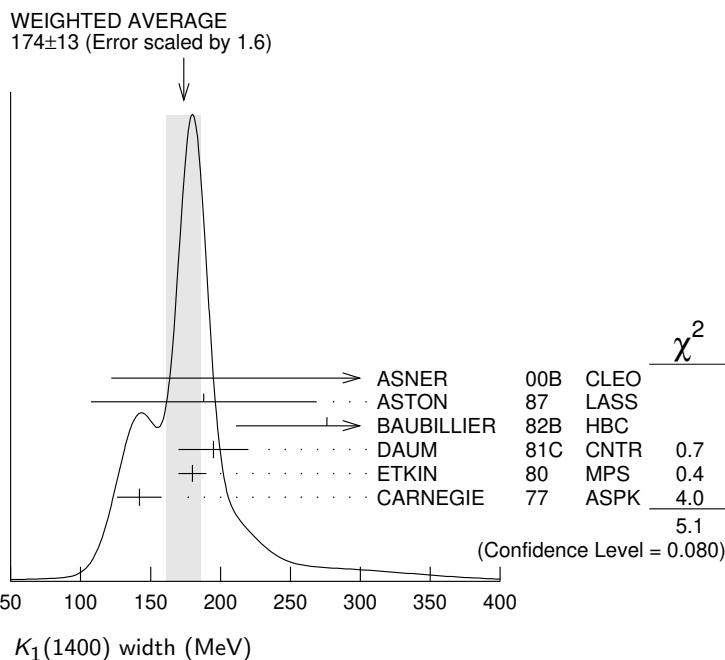
 $K_1(1400)$ WIDTH

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		⁵ 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		⁶ 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	⁷ 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	+ $12 K^+ d$

⁵ From partial-wave analysis of $K^0 \pi^+ \pi^-$ system.⁶ From a model-dependent fit with Gaussian background to BRANDENBURG 76 data.⁷ Systematic errors not estimated.

NODE=M064W;LINKAGE=P
 NODE=M064W;LINKAGE=E
 NODE=M064W;LINKAGE=AB



$K_1(1400)$ DECAY MODES

NODE=M064215;NODE=M064

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

DESIG=1

DESIG=2

DESIG=8

DESIG=5

DESIG=7;OUR EST;→ UNCHECKED ←

DESIG=9;OUR EST;→ UNCHECKED ←

$K_1(1400)$ PARTIAL WIDTHS

NODE=M064220

$\Gamma(K^*(892)\pi)$					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		
280.8 ± 23.2 ± 40.4	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$		

NODE=M064W1

NODE=M064W1

NODE=M064W2

NODE=M064W2

NODE=M064W5

NODE=M064W5

NODE=M064W6

NODE=M064W6

$K_1(1400)$ BRANCHING RATIOS

NODE=M064225

$\Gamma(K^*(892)\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.94 ± 0.06	⁸ DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	
$\Gamma(K\rho)/\Gamma_{\text{total}}$					Γ_2/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.03 ± 0.03	⁸ DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	
$\Gamma(K f_0(1370))/\Gamma_{\text{total}}$					Γ_3/Γ
VALUE	DOCUMENT ID	TECN	COMMENT		
0.02 ± 0.02	⁸ DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	

NODE=M064R1

NODE=M064R1

NODE=M064R2

NODE=M064R2

NODE=M064R5

NODE=M064R5

$\Gamma(K\omega)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.01±0.01	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R3
 NODE=M064R3

 $\Gamma(K_0^*(1430)\pi)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R4
 NODE=M064R4

D-wave/S-wave RATIO FOR $K_1(1400) \rightarrow K^*(892)\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
0.04±0.01	⁸ DAUM	81C	CNTR 63 $K^- p \rightarrow K^- 2\pi p$

NODE=M064R9
 NODE=M064R9

⁸ Average from low and high t data.

NODE=M064R;LINKAGE=F

 $K_1(1400)$ REFERENCES

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

REFID=51037
 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 $\sqrt{s}$

NODE=M094PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

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

(1368 ± 38) − i (106⁺⁴⁸_{−59}) ¹ PELAEZ 17 RVUE $\pi K \rightarrow \pi K$

NODE=M094PP

OCCUR=2

¹ Reanalysis of ESTABROOKS 78 and ASTON 88 satisfying Forward Dispersion Relations and using sequences of Pade approximants.

NODE=M094PP;LINKAGE=B

 $K^*(1410)$ MASS

NODE=M094M

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 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

OCCUR=2

¹ Using a parametrization for the $K\pi$ S -wave similar to ASTON 88 with fixed resonance width.

NODE=M094M;LINKAGE=A

² Using a $K\pi$ S -wave parametrization with resonant and non-resonant contributions.

NODE=M094M;LINKAGE=C

³ From the pole position of the $K\pi$ vector form factor in the complex s -plane and using EPIFANOV 07 data.

NODE=M094M;LINKAGE=BI

⁴ Systematic uncertainties not estimated.

NODE=M094M;LINKAGE=NS

 $K^*(1410)$ WIDTH

NODE=M094W

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 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

NODE=M094W

• • • 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 ⁺ ₋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.

OCCUR=2

NODE=M094W;LINKAGE=A

NODE=M094W;LINKAGE=BI

NODE=M094W;LINKAGE=NS

NODE=M094215;NODE=M094

$K^*(1410)$ 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 $\times 10^{-4}$	90%

DESIG=2

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

$K^*(1410)$ PARTIAL WIDTHS

$\Gamma(\gamma K^0)$					Γ_4
VALUE (keV)	CL%	DOCUMENT ID	TECN	COMMENT	
<52.9	90	ALAVI-HARATI02B	KTEV	$K + A \rightarrow K^* + A$	

NODE=M094217

NODE=M094W1

NODE=M094W1

$K^*(1410)$ BRANCHING RATIOS

$\Gamma(K\rho)/\Gamma(K^*(892)\pi)$					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=M094220

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

$K^*(1410)$ REFERENCES

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+)

NODE=M094

REFID=57836

REFID=57273

REFID=52728

REFID=51929

REFID=48822

REFID=41002

REFID=40262

REFID=40234

REFID=22689

REFID=22551

REFID=22545

REFID=22443

$K_0^*(1430)$

$$I(J^P) = \frac{1}{2}(0^+)$$

See our minireview in the 1994 edition and in this edition under the $f_0(500)$.

NODE=M019

NODE=M019

 $K_0^*(1430)$ T-MATRIX POLE $\sqrt{s}$

NODE=M019PP

NODE=M019PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1431 \pm 6) - i(110 \pm 19)$	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=M019PP;LINKAGE=A

 $K_0^*(1430)$ MASS

NODE=M019M

 NODE=M019M
 → UNCHECKED ←

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
1425 ± 50 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1438 ± 8 ± 4	5.4k	¹ LEES	14E BABR	$\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$
1427 ± 4 ± 13		² BUGG	10 RVUE	S-matrix pole
1466.6 ± 0.7 ± 3.4	141k	³ BONVICINI	08A CLEO	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1412		⁴ LINK	07 FOCS	$D^+ \rightarrow K^- K^+ \pi^+$
1461.0 ± 4.0 ± 2.1	54k	⁵ LINK	07B FOCS	$D^+ \rightarrow K^- \pi^+ \pi^+$
1406 ± 29		⁶ BUGG	06 RVUE	
1435 ± 6		⁷ 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		⁸ ZHENG	04 RVUE	$K^- p \rightarrow K^- \pi^+ n$
~ 1419		⁹ BUGG	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 1440		¹⁰ LI	03 RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
1459 ± 9	15k	¹¹ AITALA	02 E791	$D^+ \rightarrow K^- \pi^+ \pi^+$
~ 1440		¹² JAMIN	00 RVUE	$K p \rightarrow K p$
1436 ± 8		¹³ BARBERIS	98E OMEG	$450 p p \rightarrow$ $p_f p_s K^+ K^- \pi^+ \pi^-$
1415 ± 25		⁹ ANISOVICH	97C RVUE	$11 K^- p \rightarrow K^- \pi^+ n$
~ 1450		¹⁴ TORNQVIST	96 RVUE	$\pi \pi \rightarrow \pi \pi, K \bar{K}, K \pi$
1412 ± 6		¹⁵ 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		¹⁶ ESTABROOKS	78 ASPK	$13 K^\pm p \rightarrow K^\pm \pi^\pm (n, \Delta)$
~ 1450.0		MARTIN	78 SPEC	$10 K^\pm p \rightarrow K_S^0 \pi p$

NODE=M019M;LINKAGE=LE

NODE=M019M;LINKAGE=BG

 NODE=M019M;LINKAGE=BO
 NODE=M019M;LINKAGE=LI
 NODE=M019M;LINKAGE=BW
 NODE=M019M;LINKAGE=BU

 NODE=M019M;LINKAGE=ZU
 NODE=M019M;LINKAGE=ZH
 NODE=M019M;LINKAGE=A1
 NODE=M019M;LINKAGE=E
 NODE=M019M;LINKAGE=A0
 NODE=M019M;LINKAGE=JM
 NODE=M019M;LINKAGE=JP
 NODE=M019M;LINKAGE=TT
 NODE=M019M;LINKAGE=D

NODE=M019M;LINKAGE=A

¹ 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.

² 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.

³ From the isobar model with a complex pole for the κ .

⁴ From a non-parametric analysis.

⁵ A Breit-Wigner mass and width.

⁶ 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.

⁷ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$.

⁸ Using ASTON 88 and assuming $K_0^*(700)$.

⁹ T-matrix pole. Reanalysis of ASTON 88 data.

¹⁰ Breit-Wigner fit. Using ASTON 88.

¹¹ Assuming a low-mass scalar $K\pi$ resonance, $\kappa(700)$.

¹² T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹³ J^P not determined, could be $K_2^*(1430)$.

¹⁴ T-matrix pole.

¹⁵ Uses a model for the background, without this background they get a mass 1340 MeV, where the phase shift passes 90° .

¹⁶ Mass defined by pole position. From elastic $K\pi$ partial-wave analysis.

$K_0^*(1430)$ WIDTH

NODE=M019W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
270 ±80 OUR ESTIMATE				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
210 ±20 ±12	5.4k	¹ LEES	14E	BABR $\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$
270 ±10 ±40		² BUGG	10	RVUE S-matrix pole
174.2 ± 1.9 ± 3.2	141k	³ BONVICINI	08A	CLEO $D^+ \rightarrow K^- \pi^+ \pi^+$
~ 500		⁴ LINK	07	FOCS $D^+ \rightarrow K^- K^+ \pi^+$
177.0 ± 8.0 ± 3.4	54k	⁵ LINK	07B	FOCS $D^+ \rightarrow K^- \pi^+ \pi^+$
350 ±40		⁶ BUGG	06	RVUE
288 ±22		⁷ ZHOU	06	RVUE $K\rho \rightarrow K^- \pi^+ n$
270 ±45 ⁺³⁰ ₋₃₅		ABLIKIM	05Q	BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$
217 ±31		⁸ ZHENG	04	RVUE $K^- \rho \rightarrow K^- \pi^+ n$
~ 316		⁹ BUGG	03	RVUE $11 K^- \rho \rightarrow K^- \pi^+ n$
~ 350		¹⁰ LI	03	RVUE $11 K^- \rho \rightarrow K^- \pi^+ n$
175 ±17	15k	¹¹ AITALA	02	E791 $D^+ \rightarrow K^- \pi^+ \pi^+$
~ 300		¹² JAMIN	00	RVUE $K\rho \rightarrow K\rho$
196 ±45		¹³ BARBERIS	98E	OMEG $450 \rho\rho \rightarrow p_f p_s K^+ K^- \pi^+ \pi^-$
330 ±50		⁹ ANISOVICH	97C	RVUE $11 K^- \rho \rightarrow K^- \pi^+ n$
~ 320		¹⁴ TORNQVIST	96	RVUE $\pi\pi \rightarrow \pi\pi, K\bar{K}, K\pi$
294 ±23		ASTON	88	LASS $11 K^- \rho \rightarrow K^- \pi^+ n$
~ 200		BAUBILLIER	84B	HBC $8.25 K^- \rho \rightarrow \bar{K}^0 \pi^- p$
200 to 300		¹⁵ ESTABROOKS	78	ASPK $13 K^\pm \rho \rightarrow K^\pm \pi^\pm (n, \Delta)$

NODE=M019W

→ UNCHECKED ←

¹ 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 $M(K_0^*(1430)) = 1435$ MeV.

² 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.

³ From the isobar model with a complex pole for the κ .

⁴ From a non-parametric analysis.

⁵ A Breit-Wigner mass and width.

⁶ 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.

⁷ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1950)$.

⁸ Using ASTON 88 and assuming $K_0^*(700)$.

⁹ T-matrix pole. Reanalysis of ASTON 88 data.

¹⁰ Breit-Wigner fit. Using ASTON 88.

¹¹ Assuming a low-mass scalar $K\pi$ resonance, $\kappa(700)$.

¹² T-matrix pole. Using data from ESTABROOKS 78 and ASTON 88.

¹³ J^P not determined, could be $K_2^*(1430)$.

¹⁴ T-matrix pole.

¹⁵ From elastic $K\pi$ partial-wave analysis.

NODE=M019W;LINKAGE=LE

NODE=M019W;LINKAGE=BG

NODE=M019W;LINKAGE=BO
 NODE=M019W;LINKAGE=LI
 NODE=M019W;LINKAGE=BW
 NODE=M019W;LINKAGE=BU

NODE=M019W;LINKAGE=ZU
 NODE=M019W;LINKAGE=ZH
 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

NODE=M019215;NODE=M019

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(93 ±10) %
Γ_2 $K\eta$	(8.6 ⁺ ₋ 2.7 ⁺ ₋ 3.4) %
Γ_3 $K\eta'(958)$	seen

DESIG=1

DESIG=2

DESIG=3

 $K_0^*(1430)$ BRANCHING RATIOS

NODE=M019220

$\Gamma(K\pi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.93±0.04±0.09	ASTON	88	LASS	0	11 $K^- \rho \rightarrow K^- \pi^+ n$
$\Gamma(K\eta)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	
9.2±2.5^{+1.0}_{-2.5}	5.4k	¹ LEES	14E	BABR $\eta_c(1S) \rightarrow K^+ K^- \eta/\pi^0$	

NODE=M019R1
 NODE=M019R1

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

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	14J BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

NODE=M019R00
 NODE=M019R00

 $K_0^*(1430)$ REFERENCES

NODE=M019

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 (err.)	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	
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=57836
 REFID=55901
 REFID=55937
 REFID=53213
 REFID=53056
 REFID=52426
 REFID=51702
 REFID=51875
 REFID=51037
 REFID=51051
 REFID=51458
 REFID=50996
 REFID=51198
 REFID=50958
 REFID=50165
 REFID=49586
 REFID=49192
 REFID=48807
 REFID=47983
 REFID=46348
 REFID=45815
 REFID=44507
 REFID=40262
 REFID=22459
 REFID=22443
 REFID=22446

 $K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

We consider that phase-shift analyses provide more reliable determinations of the mass and width.

NODE=M022

NODE=M022

 $K_2^*(1430)$ T-MATRIX POLE $\sqrt{s}$

NODE=M022PP

NODE=M022PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$(1424 \pm 4) - i(66 \pm 2)$	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;LINKAGE=A

 $K_2^*(1430)$ MASS

NODE=M022205

CHARGED ONLY, WITH FINAL STATE $K\pi$

NODE=M022M1
 NODE=M022M1

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.			
$1432.7 \pm 0.7^{+2.2}_{-2.3}$	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	^{2,3} CLELAND	82 SPEC	+	$30 K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1500	^{2,3} CLELAND	82 SPEC	+	$50 K^+ p \rightarrow K_S^0 \pi^+ p$
1430 ± 3.2	1200	^{2,3} 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		⁴ MARTIN	78 SPEC	+	$10 K^\pm p \rightarrow K_S^0 \pi p$
1423.8 ± 4.6		⁴ MARTIN	78 SPEC	−	$10 K^\pm p \rightarrow K_S^0 \pi p$
1420.0 ± 3.1	1400	AGUILAR-...	71B HBC	−	$3.9, 4.6 K^- p$
1425 ± 8.0	225	^{2,3} BARNHAM	71C HBC	+	$K^+ p \rightarrow K^0 \pi^+ p$
1416 ± 10	220	CRENNELL	69D DBC	−	$3.9 K^- N \rightarrow \bar{K}^0 \pi^- N$
1414 ± 13.0	60	² LIND	69 HBC	+	$9 K^+ p \rightarrow K^0 \pi^+ p$
1427 ± 12	63	² SCHWEING...	68 HBC	−	$5.5 K^- p \rightarrow \bar{K} \pi N$
1423 ± 11.0	39	² BASSANO	67 HBC	−	$4.6-5.0 K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

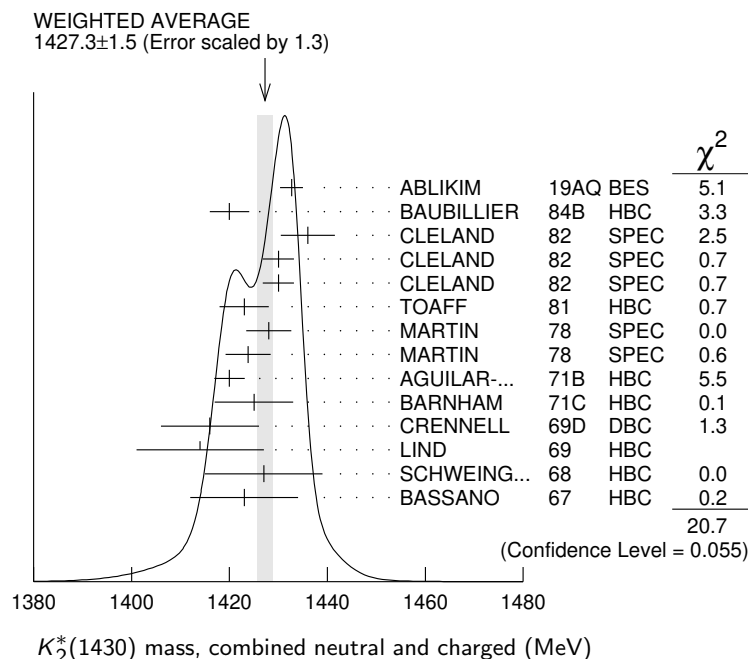
OCCUR=3

OCCUR=2

OCCUR=2

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

1423.4 ± 2 ± 3 24809 ± 5 BIRD 89 LASS - 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
820



NEUTRAL ONLY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1432.4 ± 1.3 OUR AVERAGE				
1431.2 ± 1.8 ± 0.7	6	ASTON 88	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 4 ± 6	6	ASTON 87	LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1433 ± 6 ± 10	6	ASTON 84B	LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
1471 ± 12	6	BAUBILLIER 82B	HBC	8.25 $K^- p \rightarrow NK_S^0 \pi \pi$
1428 ± 3	6	ASTON 81C	LASS	11 $K^- p \rightarrow K^- \pi^+ n$
1434 ± 2	6	ESTABROOKS 78	ASPK	13 $K^\pm p \rightarrow p K \pi$
1440 ± 10	6	BOWLER 77	DBC	5.5 $K^+ d \rightarrow K \pi p p$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1428.5 ± 3.9	1786 ± 127	7 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		8 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 $K^+ p \rightarrow K^+ \pi^- X$

² Errors enlarged by us to $\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.

³ Number of events in peak re-evaluated by us.

⁴ Systematic error added by us.

⁵ From a partial wave amplitude analysis.

⁶ From phase shift or partial-wave analysis.

⁷ Systematic errors not estimated.

⁸ From pole extrapolation, using world $K^+ p$ data summary tape.

NODE=M022M4
NODE=M022M4

NODE=M022M;LINKAGE=D
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$K_2^*(1430)$ WIDTH

NODE=M022210

CHARGED ONLY, WITH FINAL STATE $K\pi$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
100.0 ± 2.1 OUR FIT					
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	9,10 CLELAND	82 SPEC	+	30 $K^+ p \rightarrow K_S^0 \pi^+ p$
124 ± 12.8	1500	9,10 CLELAND	82 SPEC	+	50 $K^+ p \rightarrow K_S^0 \pi^+ p$
113 ± 12.8	1200	9,10 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 $K^\pm p \rightarrow K_S^0 \pi p$

NODE=M022W1
NODE=M022W1

OCCUR=2

OCCUR=3

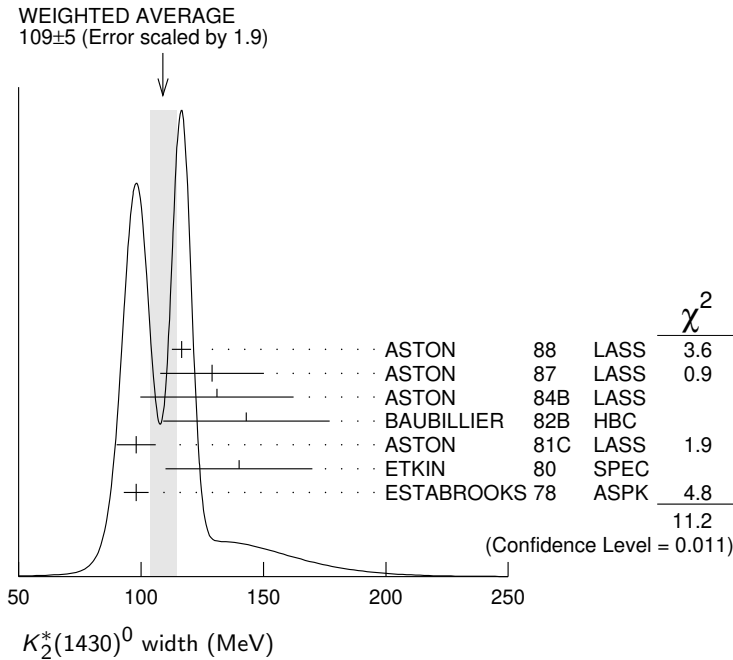
97.7 ± 4.0		MARTIN	78	SPEC	—	10 $K^\pm p \rightarrow K_S^0 \pi p$
94.7 ^{+15.1} _{-12.5}	1400	AGUILAR-...	71B	HBC	—	3.9,4.6 $K^- p$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
98 ± 4 ± 4	25k	11 BIRD	89	LASS	—	11 $K^- p \rightarrow \bar{K}^0 \pi^- p$

OCCUR=2

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		12 ASTON	88 LASS	11 $K^- p \rightarrow K^- \pi^+ n$
129 ±15 ±15		12 ASTON	87 LASS	11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
131 ±24 ±20		12 ASTON	84B LASS	11 $K^- p \rightarrow \bar{K}^0 2\pi n$
143 ±34		12 BAUBILLIER	82B HBC	8.25 $K^- p \rightarrow N K_S^0 \pi \pi$
98 ± 8		12 ASTON	81C LASS	11 $K^- p \rightarrow K^- \pi^+ n$
140 ±30		12 ETKIN	80 SPEC	6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
98 ± 5		12 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	13 AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow K^{*0} K^\pm \pi^\mp \gamma$
125 ±29	300	9 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		14 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	9 CORDS	71 DBC	9 $K^+ n \rightarrow K^+ \pi^- p$
101 ±10	2200	DAVIS	69 HBC	12 $K^+ p \rightarrow K^+ \pi^- \pi^+ p$

NODE=M022W4
NODE=M022W4



- ⁹ Errors enlarged by us to $4\Gamma/\sqrt{N}$; see the note with the $K^*(892)$ mass.
¹⁰ Number of events in peak re-evaluated by us.
¹¹ From a partial wave amplitude analysis.
¹² From phase shift or partial-wave analysis.
¹³ Systematic errors not estimated.
¹⁴ From pole extrapolation, using world $K^+ p$ data summary tape.

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NODE=M022W;LINKAGE=F
NODE=M022W;LINKAGE=P
NODE=M022W4;LINKAGE=NS
NODE=M022W;LINKAGE=C

$K_2^*(1430)$ DECAY MODES

NODE=M022215;NODE=M022

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

DESIG=1
DESIG=2
DESIG=6
DESIG=3

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	−10	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

$\Gamma(K^+\gamma)$	VALUE (keV)	DOCUMENT ID	TECN	CHG	COMMENT	Γ_6
241 ± 50 OUR FIT					Error includes scale factor of 1.1.	
240 ± 45		CIHANGIR	82	SPEC	+ 200 $K^+ Z \rightarrow Z K^+ \pi^0$, $Z K_S^0 \pi^+$	

NODE=M022W8
NODE=M022W8

$\Gamma(K^0\gamma)$	VALUE (keV)	CL%	DOCUMENT ID	TECN	CHG	COMMENT	Γ_9
< 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

$\Gamma(K\pi)/\Gamma_{\text{total}}$	VALUE	DOCUMENT ID	TECN	CHG	COMMENT	Γ_1/Γ
0.499 ± 0.012 OUR FIT						
0.488 ± 0.014 OUR AVERAGE						
$0.485 \pm 0.006 \pm 0.020$	¹⁵ ASTON	88	LASS	0	11 $K^- p \rightarrow K^- \pi^+ n$	
0.49 ± 0.02	¹⁵ ESTABROOKS	78	ASPK	±	13 $K^\pm p \rightarrow p K \pi$	

NODE=M022R1
NODE=M022R1

$\Gamma(K^*(892)\pi)/\Gamma(K\pi)$ 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 $K^+ p$

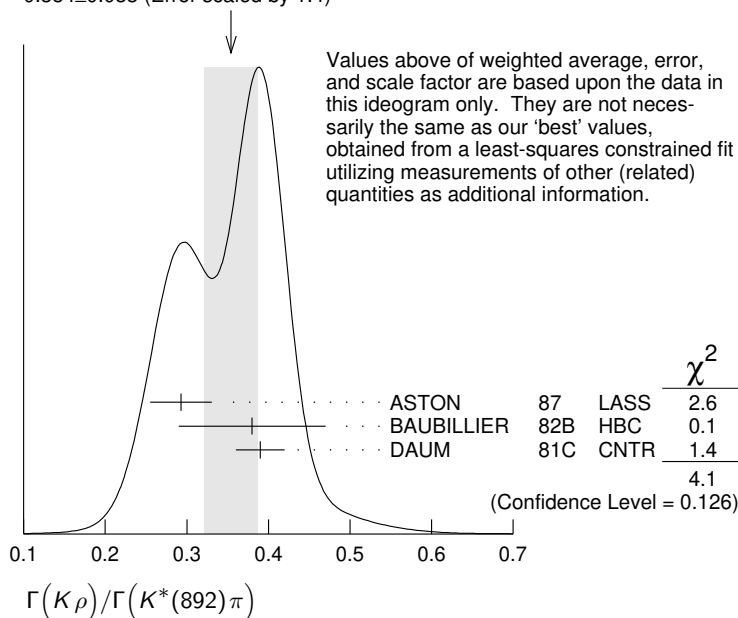
OCCUR=2

 $\Gamma(K\rho)/\Gamma(K\pi)$ 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 16 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 17 BASSOMPIE... 69 HBC 5.0 $K^+ p$

<0.02 BISHOP 69 HBC 3.5 $K^+ p$

 Γ_7/Γ_1

NODE=M022R10
NODE=M022R10

 $\Gamma(K^*(892)\pi\pi)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.134 ± 0.022 OUR FIT

0.12 ± 0.04 18 GOLDBERG 76 HBC — 3 $K^- p \rightarrow p \bar{K}^0 \pi \pi$

 Γ_3/Γ

NODE=M022R11
NODE=M022R11

 $\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT

0.27 ± 0.05 OUR FIT

0.21 ± 0.08 17,18 JONGEJANS 78 HBC — 4 $K^- p \rightarrow p \bar{K}^0 \pi \pi$

 Γ_3/Γ_1

NODE=M022R12
NODE=M022R12

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

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

15 From phase shift analysis.

16 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.

17 Restated by us.

18 Assuming $\pi\pi$ system has isospin 1, which is supported by the data.

NODE=M022R;LINKAGE=P
NODE=M022R;LINKAGE=PQ

NODE=M022R;LINKAGE=R
NODE=M022R;LINKAGE=T

 $K_2^*(1430)$ REFERENCES

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, NIJ+)
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=59909
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REFID=22690

K(1460)

$I(J^P) = \frac{1}{2}(0^-)$

OMITTED FROM SUMMARY TABLE
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	$K^\pm p \rightarrow K^+ 2\pi p$
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	$K^\pm p \rightarrow K^+ 2\pi p$
¹ Coupled mainly to $K f_0(1370)$. Decay into $K^*(892)\pi$ seen.					

K(1460) DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad K^*(892)\pi$	seen
$\Gamma_2 \quad K\rho$	seen
$\Gamma_3 \quad K^*_0(1430)\pi$	seen

K(1460) PARTIAL WIDTHS

$\Gamma(K^*(892)\pi)$					Γ_1
<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
• • • 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
<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
• • • 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
<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>		
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 117	DAUM	81C	CNTR	63 $K^- p \rightarrow K^- 2\pi p$	

K(1460) REFERENCES

AAIJ	18AI	EPJ C78 443	R. Aaij <i>et al.</i>	(LHCb Collab.)
DAUM	81C	NP B187 1	C. Daum <i>et al.</i>	(AMST, CERN, CRAC, MPIM+)
BRANDENB...	76B	PRL 36 1239	G.W. Brandenburg <i>et al.</i>	(SLAC) JP

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 ←

NODE=M021220

NODE=M021W1
NODE=M021W1

NODE=M021W2
NODE=M021W2

NODE=M021W3
NODE=M021W3

NODE=M021

REFID=59187
REFID=22548
REFID=22767

$K_2(1580)$

$$I(J^P) = \frac{1}{2}(2^-)$$

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
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>CHG</i>	<i>COMMENT</i>	
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
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
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

$K(1630)$

$$I(J^P) = \frac{1}{2}(?^?)$$

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.

 $K(1630)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1629±7	~ 75	KARNAUKHOV98	BC	$16.0 \pi^- p \rightarrow (K_S^0 \pi^+ \pi^-) X^+ \pi^- X^0$

 $K(1630)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
16⁺¹⁹₋₁₆	~ 75	¹ KARNAUKHOV98	BC	$16.0 \pi^- p \rightarrow (K_S^0 \pi^+ \pi^-) X^+ \pi^- X^0$

¹ Compatible with an experimental resolution of 14 ± 1 MeV.

 $K(1630)$ DECAY MODES

Mode
$\Gamma_1 \quad K_S^0 \pi^+ \pi^-$

 $K(1630)$ REFERENCES

KARNAUKHOV 98 PAN 61 203 V.M. Karaukhov, C. Coca, V.I. Moroz
Translated from YAF 61 252.

 $K_1(1650)$

$$I(J^P) = \frac{1}{2}(1^+)$$

OMITTED FROM SUMMARY TABLE

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.

 $K_1(1650)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1672±50 OUR AVERAGE		Error includes scale factor of 1.1.			
$1793 \pm 59^{+153}_{-101}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1650 ± 50		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 1840		ARMSTRONG	83	OMEG -	$18.5 K^- p \rightarrow 3 K p$
~ 1800		DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

 $K_1(1650)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
158± 50 OUR AVERAGE					
$365 \pm 157^{+138}_{-215}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
150 ± 50		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
~ 250		DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$

² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 7.6σ .

NODE=M160

NODE=M160

NODE=M160M

NODE=M160M

NODE=M160W

NODE=M160W

NODE=M160W;LINKAGE=A

NODE=M160215;NODE=M160

DESIG=1

NODE=M160

REFID=46371

NODE=M099

NODE=M099

NODE=M099M

NODE=M099M

NODE=M099M;LINKAGE=A

NODE=M099W

NODE=M099W

NODE=M099W;LINKAGE=A

$K_1(1650)$ 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	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=57657
REFID=57636
REFID=20569
REFID=22801
REFID=22548

 $K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

NODE=M095

 $K^*(1680)$ MASS

NODE=M095M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1718±18 OUR AVERAGE					
1722±20 ⁺³³ ₋₁₀₉	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi\phi K^+$
1677±10± 32		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1735±10± 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 8.5 σ .

NODE=M095M;LINKAGE=A

 $K^*(1680)$ WIDTH

NODE=M095W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
322±110 OUR AVERAGE Error includes scale factor of 4.2.					
354± 75 ⁺¹⁴⁰ ₋₁₈₁	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi\phi K^+$
205± 16± 34		ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
423± 18± 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 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 8.5 σ .

NODE=M095W;LINKAGE=A

 $K^*(1680)$ DECAY MODES

NODE=M095215;NODE=M095

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(38.7±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	4289	³ 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 8.5σ .

NODE=M095R00;LINKAGE=A

$\Gamma(K\eta)/\Gamma(K\pi)$						Γ_5/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
$0.037 \pm 0.007^{+0.024}_{-0.018}$	116k	⁴ CHEN	20A	BELL $D^0 \rightarrow K^- \pi^+ \eta$		

NODE=M095R02
NODE=M095R02

⁴ CHEN 20A quotes the ratio $\Gamma(K^*(1680)^- \rightarrow K^- \eta) / \Gamma(K^*(1680)^- \rightarrow K^- \pi^0) = 0.11 \pm 0.02^{+0.06}_{-0.04} \pm 0.04(\text{BPDG})$ 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 $\Gamma(K^*(1680)^- \rightarrow K^- \pi^0) / \Gamma(K^*(1680)^- \rightarrow (K\pi)^-) = 1/3$.

NODE=M095R02;LINKAGE=A

$\Gamma(K\eta)/\Gamma_{\text{total}}$						Γ_5/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT		

NODE=M095R01
NODE=M095R01

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

$1.44 \pm 0.21^{+0.96}_{-0.73}$	116k	⁵ CHEN	20A	BELL $D^0 \rightarrow K^- \pi^+ \eta$		

⁵ From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 16σ . Not independent of the CHEN 20A measurement of $\Gamma(K^*(1680) \rightarrow K\eta) / \Gamma(K^*(1680) \rightarrow K\pi)$.

NODE=M095R01;LINKAGE=A

$K^*(1680)$ REFERENCES

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

NODE=M095

REFID=60333
 REFID=57657
 REFID=57636
 REFID=41002
 REFID=40262
 REFID=40234
 REFID=22689
 REFID=22545
 REFID=22443

NODE=M023

 $K_2(1770)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review*, PDG 04.

NODE=M023

 $K_2(1770)$ MASS

NODE=M023M

NODE=M023M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1773± 8 OUR AVERAGE					
1777±35 ⁺¹²² ₋₇₇	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
1773± 8		² ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1743±15		TIKHOMIROV 03	SPEC		$40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$
1810±20		FRAME	86	OMEG +	$13 K^+ p \rightarrow \phi K^+ p$
~ 1730		ARMSTRONG	83	OMEG -	$18.5 K^- p \rightarrow 3K p$
~ 1780		³ DAUM	81C	CNTR -	$63 K^- p \rightarrow K^- 2\pi p$
1710±15	60	CHUNG	74	HBC -	$7.3 K^- p \rightarrow K^- \omega p$
1767± 6		BLIEDEN	72	MMS -	$11-16 K^- p$
1730±20	306	⁴ FIRESTONE	72B	DBC +	$12 K^+ d$
1765±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±20		AGUILAR-...	70C	HBC -	$4.6 K^- p$
1780±15		BARTSCH	70C	HBC -	$10.1 K^- p$
1760±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.

NODE=M023M;LINKAGE=C
 NODE=M023M;LINKAGE=A
 NODE=M023M;LINKAGE=B
 NODE=M023M;LINKAGE=P
 NODE=M023M;LINKAGE=X

 $K_2(1770)$ WIDTH

NODE=M023W

NODE=M023W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
186± 14 OUR AVERAGE					
217±116 ⁺²²¹ ₋₁₅₄	4289	⁶ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
186± 14		⁷ ASTON	93	LASS	$11K^- p \rightarrow K^- \omega p$
• • • 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 ⁺ ₋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

NODE=M023215;NODE=M023

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 $K f_0(980)$	
Γ_6 $K\phi$	seen
Γ_7 $K\omega$	seen

DESIG=1;OUR EST;→ UNCHECKED ←
 DESIG=2;OUR EST;→ UNCHECKED ←
 DESIG=4;OUR EST;→ UNCHECKED ←
 DESIG=9;OUR EST;→ UNCHECKED ←
 DESIG=11
 DESIG=10
 DESIG=8

 $K_2(1770)$ BRANCHING RATIOS

NODE=M023220

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$ **Γ_2/Γ_1**
 $(K_2^*(1430) \rightarrow K\pi)$

NODE=M023R1

NODE=M023R1

NODE=M023R1

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=M023R1;LINKAGE=P

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$ **Γ_3/Γ_1**

NODE=M023R3

NODE=M023R3

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**
 $(f_2(1270) \rightarrow \pi\pi)$

NODE=M023R4

NODE=M023R4

NODE=M023R4

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**

NODE=M023R6

NODE=M023R6

VALUE	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
possibly seen	TIKHOMIROV	03	SPEC $40.0 \pi^- C \rightarrow K_S^0 K_S^0 K_L^0 X$

$\Gamma(K\phi)/\Gamma_{\text{total}}$ **Γ_6/Γ**

NODE=M023R5

NODE=M023R5

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
seen	4289	¹² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
seen		ARMSTRONG	83	OMEG	$- 18.5 K^- p \rightarrow K^- \phi N$

¹² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.0σ .

NODE=M023R5;LINKAGE=A

$\Gamma(K\omega)/\Gamma_{\text{total}}$ **Γ_7/Γ**

NODE=M023R2

NODE=M023R2

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	OTTER	81	HBC	$\pm 8.25, 10, 16 K^\pm p$
seen	CHUNG	74	HBC	$- 7.3 K^- p \rightarrow K^- \omega p$

 $K_2(1770)$ REFERENCES

NODE=M023

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>	
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)

REFID=57657

REFID=57636

REFID=49653

REFID=49423

REFID=43597

REFID=20569

REFID=22801

REFID=22548

REFID=22549

REFID=22735

REFID=22788

REFID=22506

REFID=22785

REFID=22497

REFID=22782

REFID=22783

REFID=22784

REFID=22483

$K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

NODE=M060

 $K_3^*(1780)$ T-MATRIX POLE $\sqrt{s}$

NODE=M060PP

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M060PP

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

(1754 ± 13) − i (119 ± 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;LINKAGE=A

 $K_3^*(1780)$ MASS

NODE=M060M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

1779 ± 8 OUR AVERAGE Error includes scale factor of 1.2. [1776 ± 7 MeV OUR 2020 AVERAGE Scale factor = 1.1]

NODE=M060M

NEW

1813 ± 15 ⁺⁶⁵ _{−16}	18k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
1781 ± 8 ± 4		² ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1740 ± 14 ± 15		² ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1779 ± 11		³ BALDI	76	SPEC	+
1776 ± 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 ± 10 ± 15	6111	⁵ BIRD	89	LASS	− 11 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1749 ± 10		ASTON	88B	LASS	− 11 $K^- p \rightarrow K^- \eta p$
1780 ± 9	300	BAUBILLIER	84B	HBC	− 8.25 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1790 ± 15		BAUBILLIER	82B	HBC	0 8.25 $K^- p \rightarrow K_S^0 2\pi N$
1784 ± 9	2060	CLELAND	82	SPEC	± 50 $K^+ p \rightarrow K_S^0 \pi^\pm p$
1786 ± 15		⁶ ASTON	81D	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1762 ± 9	190	TOAFF	81	HBC	− 6.5 $K^- p \rightarrow \bar{K}^0 \pi^- p$
1850 ± 50		ETKIN	80	MPS	0 6 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^-$
1812 ± 28		BEUSCH	78	OMEG	10 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$
1786 ± 8		CHUNG	78	MPS	0 6 $K^- p \rightarrow K^- \pi^+ n$

¹ Seen in $\psi(2S)$ decay with branching ratio $\psi(2S) \rightarrow K^\pm X \rightarrow K^+ K^- \eta = (2.0 \pm 0.4 \pm 1.9 \pm 0.4) \times 10^{-6}$.

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

161 ± 17 OUR AVERAGE Error includes scale factor of 1.1. [159 ± 21 MeV OUR 2020 AVERAGE Scale factor = 1.3]

NODE=M060W

NEW

191 ⁺⁴³ _{−37} ± 3 _{−81}	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
203 ± 30 ± 8		² ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
171 ± 42 ± 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 ± 31 ± 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
$\Gamma_1 K \rho$	$(31 \pm 9) \%$	
$\Gamma_2 K^*(892) \pi$	$(20 \pm 5) \%$	
$\Gamma_3 K \pi$	$(18.8 \pm 1.0) \%$	
$\Gamma_4 K \eta$	$(30 \pm 13) \%$	
$\Gamma_5 K_2^*(1430) \pi$	$< 16 \%$	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						
$1.52 \pm 0.21 \pm 0.10$	ASTON	87	LASS	0	$11 K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$	
$\Gamma(K^*(892) \pi)/\Gamma(K \pi)$						Γ_2/Γ_3
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
1.09 ± 0.26 OUR FIT						
1.09 ± 0.26	ASTON	84B	LASS	0	$11 K^- p \rightarrow \bar{K}^0 2 \pi n$	
$\Gamma(K \pi)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT		
0.188 ± 0.010 OUR FIT						
0.188 ± 0.010 OUR AVERAGE						
$0.187 \pm 0.008 \pm 0.008$	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=M060R5
NODE=M060R5NODE=M060R7
NODE=M060R7NODE=M060R4
NODE=M060R4

$\Gamma(K\eta)/\Gamma(K\pi)$

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 $K^- p \rightarrow K^- \eta p$

¹ This result supersedes ASTON 88B. $\Gamma(K_2^*(1430)\pi)/\Gamma(K^*(892)\pi)$

VALUE	CL%	DOCUMENT ID	TECN	CHG	COMMENT

<0.78	95	ASTON	87	LASS	0 11 $K^- p \rightarrow \bar{K}^0 \pi^+ \pi^- n$

 $K_2^*(1780)$ REFERENCES

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PELAEZ	17	EPJ C77 91	J.R. Pelaez, A.Rodas, J.R. de Elvira	
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) JP
ASTON	87	NP B292 693	D. Aston <i>et al.</i>	(SLAC, NAGO, CINC, INUS)
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+)
CLELAND	82	NP B208 189	W.E. Cleland <i>et al.</i>	(DURH, GEVA, LAUS+)
ASTON	81D	PL 99B 502	D. Aston <i>et al.</i>	(SLAC, CARL, OTTA) JP
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
BEUSCH	78	PL 74B 282	W. Beusch <i>et al.</i>	(CERN, AACH3, ETH) JP
CHUNG	78	PRL 40 355	S.U. Chung <i>et al.</i>	(BNL, BRAN, CUNY+) JP
ESTABROOKS	78	NP B133 490	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+) JP
Also		PR D17 658	P.G. Estabrooks <i>et al.</i>	(MCGI, CARL, DURH+)
BALDI	76	PL 63B 344	R. Baldi <i>et al.</i>	(GEVA) JP
BRANDENB...	76D	PL 60B 478	G.W. Brandenburg <i>et al.</i>	(SLAC) JP

 $K_2(1820)$

$$I(J^P) = \frac{1}{2}(2^-)$$

See our mini-review in the 2004 edition of this *Review* (PDG 04) under $K_2(1770)$. **$K_2(1820)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT

1819 ± 12 OUR AVERAGE

1853 ± 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 $63 K^- p \rightarrow K^- 2\pi p$

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 ± 58 ⁺⁸² ₋₇₂	4289	⁴ AAIJ	17C	LHCB $B^+ \rightarrow J/\psi \phi K^+$

276 ± 35		⁵ ASTON	93	LASS $11K^- p \rightarrow K^- \omega p$

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

~ 230		⁶ DAUM	81C	CNTR $63 K^- p \rightarrow K^- 2\pi p$

⁴ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.0 σ .⁵ From a partial wave analysis of the $K^- \omega$ system.⁶ From a partial wave analysis of the $K^- 2\pi$ system. Γ_4/Γ_3 NODE=M060R8
NODE=M060R8 Γ_5/Γ_2 NODE=M060R6
NODE=M060R6

NODE=M060R8;LINKAGE=H

NODE=M060

REFID=60256
REFID=57836
REFID=41002
REFID=40262
REFID=40281
REFID=40234
REFID=22763
REFID=22459
REFID=22551
REFID=22455
REFID=22820
REFID=22454
REFID=22545
REFID=22537
REFID=22814
REFID=22443
REFID=22444
REFID=22807
REFID=22808

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

K₂(1820) DECAY MODES

NODE=M146215;NODE=M146

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 $K\omega$	seen
Γ_6 $K\phi$	seen

DESIG=5
DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=2;OUR EVAL;→ UNCHECKED ←
DESIG=3;OUR EVAL;→ UNCHECKED ←
DESIG=6;OUR EVAL;→ UNCHECKED ←
DESIG=7

K₂(1820) BRANCHING RATIOS

NODE=M146220

$\Gamma(K_2^*(1430)\pi)/\Gamma(K\pi\pi)$	Γ_2/Γ_1
VALUE	DOCUMENT ID TECN COMMENT

NODE=M146R1
NODE=M146R1

• • • We do not use the following data for averages, fits, limits, etc. • • •
~ 0.77 DAUM 81C CNTR 63K⁻ p → $\bar{K}2\pi p$

$\Gamma(K^*(892)\pi)/\Gamma(K\pi\pi)$	Γ_3/Γ_1
VALUE	DOCUMENT ID TECN COMMENT

NODE=M146R2
NODE=M146R2

• • • We do not use the following data for averages, fits, limits, etc. • • •
~ 0.05 DAUM 81C CNTR 63K⁻ p → $\bar{K}2\pi p$

$\Gamma(K f_2(1270))/\Gamma(K\pi\pi)$	Γ_4/Γ_1
VALUE	DOCUMENT ID TECN COMMENT

NODE=M146R3
NODE=M146R3

• • • We do not use the following data for averages, fits, limits, etc. • • •
~ 0.18 DAUM 81C CNTR 63K⁻ p → $\bar{K}2\pi p$

$\Gamma(K\phi)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	EVTS DOCUMENT ID TECN COMMENT

NODE=M146R00
NODE=M146R00

seen 4289 ⁷ AAIJ 17C LHCB B⁺ → J/ψ φ K⁺
⁷ From an amplitude analysis of the decay B⁺ → J/ψ φ K⁺ with a significance of 3.0 σ.

NODE=M146R00;LINKAGE=A

K₂(1820) REFERENCES

NODE=M146

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+)

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. **$K(1830)$ MASS**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$1874 \pm 43^{+59}_{-115}$	4289	¹ AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$

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

~ 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 3.5σ . **$K(1830)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
$168 \pm 90^{+280}_{-104}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$

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

~ 250

ARMSTRONG 83 OMEG - $18.5 K^- p \rightarrow 3K p$ ² From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 3.5σ . **$K(1830)$ DECAY MODES**

Mode

 $\Gamma_1 K\phi$ **$K(1830)$ REFERENCES**

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

 $K_0^*(1950)$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE

Seen in partial-wave analysis of the $K^- \pi^+$ system. Needs confirmation. **$K_0^*(1950)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$1945 \pm 10 \pm 20$	¹ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
1917 ± 12	² ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
1820 ± 40	³ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

¹ We take the central value of the two solutions and the larger error given.² S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.³ T-matrix pole. Reanalysis of ASTON 88 data. **$K_0^*(1950)$ WIDTH**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$201 \pm 34 \pm 79$	⁴ ASTON	88	LASS	0 11 $K^- p \rightarrow K^- \pi^+ n$
145 ± 38	⁵ ZHOU	06	RVUE	$K p \rightarrow K^- \pi^+ n$
250 ± 100	⁶ ANISOVICH	97C	RVUE	11 $K^- p \rightarrow K^- \pi^+ n$

⁴ We take the central value of the two solutions and the larger error given.⁵ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.⁶ T-matrix pole. Reanalysis of ASTON 88 data.

NODE=M088

NODE=M088

NODE=M088M

NODE=M088M

NODE=M088M;LINKAGE=A

NODE=M088W

NODE=M088W

NODE=M088W;LINKAGE=A

NODE=M088215;NODE=M088

DESIG=1

NODE=M088

REFID=57657
REFID=57636
REFID=22801

NODE=M134

NODE=M134

NODE=M134M

NODE=M134M

NODE=M134M;LINKAGE=A

NODE=M134M;LINKAGE=ZU

NODE=M134M;LINKAGE=A1

NODE=M134W

NODE=M134W

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)
$\Gamma_1 \quad K^- \pi^+$	$(52 \pm 14) \%$

DESIG=1

 $K_0^*(1950)$ BRANCHING RATIOS

NODE=M134220

$\Gamma(K^- \pi^+)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
$0.52 \pm 0.08 \pm 0.12$	⁷ 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	⁸ ZHOU	06	RVUE		$K p \rightarrow K^- \pi^+ n$
⁷ We take the central value of the two solutions and the larger error given.					
⁸ S-matrix pole. Using ASTON 88 and assuming $K_0^*(700)$, $K_0^*(1430)$.					

NODE=M134R1
NODE=M134R1NODE=M134R1;LINKAGE=A
NODE=M134R1;LINKAGE=ZU **$K_0^*(1950)$ REFERENCES**

NODE=M134

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=51198
REFID=45815
REFID=40262

NODE=M104

 $K_2^*(1980)$

$$I(J^P) = \frac{1}{2}(2^+)$$

OMITTED FROM SUMMARY TABLE

Needs confirmation.

NODE=M104

 $K_2^*(1980)$ MASS

NODE=M104M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
1995^{+60}_{-50} OUR AVERAGE	Error includes scale factor of 2.8. See the ideogram below.				
[1943 $\pm$ 50 MeV OUR 2020 AVERAGE Scale factor = 2.2]					
2046^{+17+67}_{-16-15}	1.8k	¹ ABLIKIM	20F	BES3	$\psi(2S) \rightarrow K^+ K^- \eta$
$1868 \pm 8^{+40}_{-57}$	183k	ABLIKIM	19AQBES	$\pm$	$J/\psi \rightarrow K^+ K^- \pi^0$
$2073 \pm 94^{+245}_{-240}$	4289	² AAIJ	17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$
$1973 \pm 8 \pm 25$		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. ● ● ●					
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 -	$11 K^- p \rightarrow \bar{K}^0 \pi^- p$

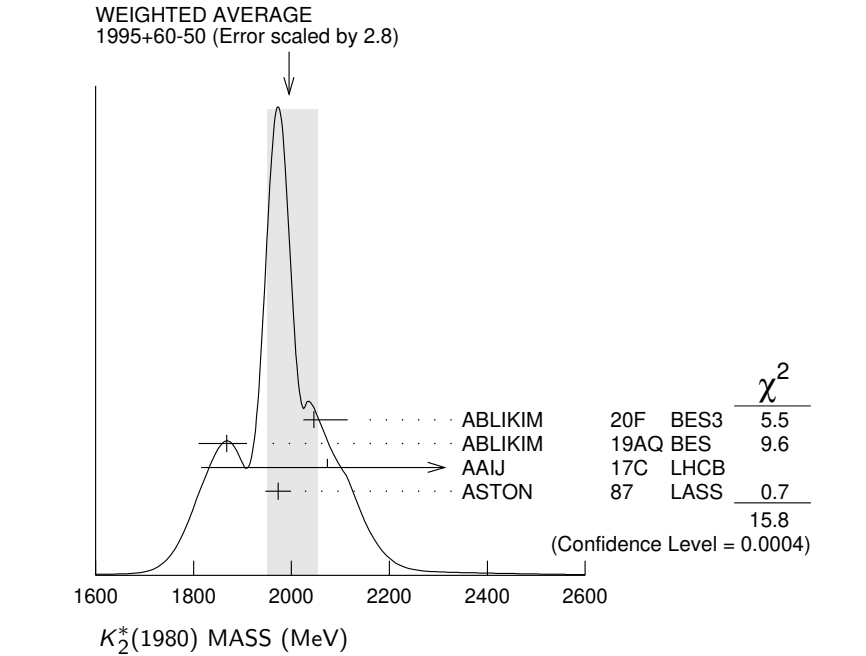
NODE=M104M

NEW

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 .

NODE=M104M;LINKAGE=C

NODE=M104M;LINKAGE=B



$K_2^*(1980)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	CHG	COMMENT
349^{+50}_{-30} OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
$[307^{+50}_{-31}$ MeV OUR 2020 AVERAGE Scale factor = 1.2]					
408^{+38}_{-34}	72^{+44}_{-44}	1.8k	1	ABLIKIM	20F BES3 $\psi(2S) \rightarrow K^+ K^- \eta$
272 ± 24	50^{+15}_{-15}	183k		ABLIKIM	19AQBES $\pm J/\psi \rightarrow K^+ K^- \pi^0$
678 ± 311	1153^{+559}_{-559}	4289	2	AAIJ	17C LHCB $B^+ \rightarrow J/\psi \phi K^+$
373 ± 33	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. • • •					
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 .

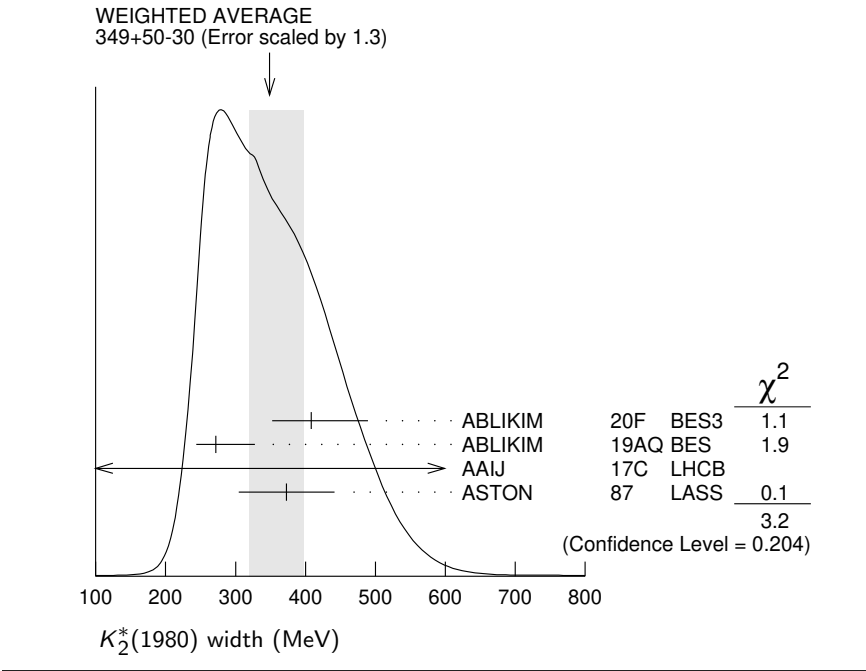
NODE=M104W

NODE=M104W

NEW

NODE=M104W;LINKAGE=C

NODE=M104W;LINKAGE=B



$K_2^*(1980)$ 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 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 5.4 σ .

NODE=M104R00;LINKAGE=A

 $\Gamma(K\eta)/\Gamma_{\text{total}}$ **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 $\psi(2S) \rightarrow K^+ K^- \eta$.² From an amplitude analysis of the decay $D^0 \rightarrow K^- \pi^+ \eta$ with a significance of 17 σ .

NODE=M104R03;LINKAGE=A

NODE=M104R03;LINKAGE=B

 $K_2^*(1980)$ REFERENCES

NODE=M104

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)

REFID=60256

REFID=60333

REFID=59909

REFID=57657

REFID=57636

REFID=53668

REFID=49423

REFID=41002

REFID=40234

$K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

NODE=M035

 $K_4^*(2045)$ MASS

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	±	$J/\psi \rightarrow K^+ K^- \pi^0$
2062 [±] 14 [±] 13		¹ ASTON	86 LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$
2039 [±] 10	400	^{2,3} CLELAND	82 SPEC	±	$50 K^+ p \rightarrow K_S^0 \pi^\pm p$
2070 ⁺¹⁰⁰ ₋₄₀		⁴ ASTON	81C LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2079 [±] 7	431	TORRES	86 MPSF		$400 pA \rightarrow 4KX$
2088 [±] 20	650	BAUBILLIER	82 HBC	—	$8.25 K^- p \rightarrow K_S^0 \pi^- p$
2115 [±] 46	488	CARMONY	77 HBC	0	$9 K^+ d \rightarrow K^+ \pi's X$
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

NODE=M035M;LINKAGE=E
 NODE=M035M;LINKAGE=B
 NODE=M035M;LINKAGE=W
 NODE=M035M;LINKAGE=D

 $K_4^*(2045)$ WIDTH

NODE=M035W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
199⁺²⁷₋₁₉ OUR AVERAGE					
201 [±] 19 ⁺⁵⁷ ₋₁₇	183k	ABLIKIM	19AQ BES	±	$J/\psi \rightarrow K^+ K^- \pi^0$
221 [±] 48 [±] 27		⁵ ASTON	86 LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$
189 [±] 35	400	^{6,7} CLELAND	82 SPEC	±	$50 K^+ p \rightarrow K_S^0 \pi^\pm p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
61 [±] 58	431	TORRES	86 MPSF		$400 pA \rightarrow 4KX$
170 ⁺¹⁰⁰ ₋₅₀	650	BAUBILLIER	82 HBC	—	$8.25 K^- p \rightarrow K_S^0 \pi^- p$
240 ⁺⁵⁰⁰ ₋₁₀₀		⁸ ASTON	81C LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$
300 [±] 200		CARMONY	77 HBC	0	$9 K^+ d \rightarrow K^+ \pi's X$
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

NODE=M035W;LINKAGE=E
 NODE=M035W;LINKAGE=B
 NODE=M035W;LINKAGE=W
 NODE=M035W;LINKAGE=D

 $K_4^*(2045)$ DECAY MODES

NODE=M035215;NODE=M035

Mode	Fraction (Γ_i/Γ)
Γ_1 $K\pi$	(9.9 $\pm$ 1.2) %
Γ_2 $K^*(892)\pi\pi$	(9 $\pm$ 5) %
Γ_3 $K^*(892)\pi\pi\pi$	(7 $\pm$ 5) %
Γ_4 $\rho K\pi$	(5.7 $\pm$ 3.2) %
Γ_5 $\omega K\pi$	(5.0 $\pm$ 3.0) %
Γ_6 $\phi K\pi$	(2.8 $\pm$ 1.4) %
Γ_7 $\phi K^*(892)$	(1.4 $\pm$ 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$\pm$0.012	ASTON	88	LASS	0	$11 K^- p \rightarrow K^- \pi^+ n$
$\Gamma(K^*(892)\pi\pi)/\Gamma(K\pi)$					Γ_2/Γ_1
VALUE	DOCUMENT ID	TECN	CHG	COMMENT	
0.89$\pm$0.53	BAUBILLIER	82	HBC	—	$8.25 K^- p \rightarrow p K_S^0 3\pi$

NODE=M035R1
 NODE=M035R1

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	CHG	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	CHG	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

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)

NODE=M035

REFID=59909
 REFID=40262
 REFID=22462
 REFID=22845
 REFID=22842
 REFID=22455
 REFID=22821
 REFID=22811

NODE=M040

 $K_2(2250)$

$$I(J^P) = \frac{1}{2}(2^-)$$

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

 $K_2(2250)$ 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.

NODE=M040M

NODE=M040M

NODE=M040M;LINKAGE=Q

 $K_2(2250)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
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.

NODE=M040W

NODE=M040W

NODE=M040W;LINKAGE=Q

K₂(2250) DECAY MODES

NODE=M040215;NODE=M040

Mode	
Γ_1	$K \pi \pi$
Γ_2	$K f_2(1270)$
Γ_3	$K^*(892) f_0(980)$
Γ_4	$\rho \bar{\Lambda}$

DESIG=1
DESIG=3
DESIG=4
DESIG=2

K₂(2250) REFERENCES

NODE=M040

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... 79	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)

REFID=49423
REFID=22852
REFID=22850
REFID=22851
REFID=22849
REFID=22847

K₃(2320)

$I(J^P) = \frac{1}{2}(3^+)$

NODE=M090

OMITTED FROM SUMMARY TABLE
Seen in the $J^P = 3^+$ wave of the antihyperon-nucleon system.
Needs confirmation.

NODE=M090

K₃(2320) MASS

NODE=M090M

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.				

NODE=M090M

NODE=M090M;LINKAGE=P

K₃(2320) WIDTH

NODE=M090W

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.				

NODE=M090W

NODE=M090W;LINKAGE=P

K₃(2320) DECAY MODES

NODE=M090215;NODE=M090

Mode	
Γ_1	$\rho \bar{\Lambda}$

DESIG=1

K₃(2320) REFERENCES

NODE=M090

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+)

REFID=22852
REFID=22851

$K_5^*(2380)$

$$I(J^P) = \frac{1}{2}(5^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation. **$K_5^*(2380)$ MASS**

VALUE (MeV)	DOCUMENT ID	TECN	CHG	COMMENT
$2382 \pm 14 \pm 19$	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
$178 \pm 37 \pm 32$	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)
Γ_1 $K \pi$	(6.1 $\pm$ 1.2) %

 $K_5^*(2380)$ 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 $K^- p \rightarrow K^- \pi^+ n$	

 $K_5^*(2380)$ 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)

 $K_4(2500)$

$$I(J^P) = \frac{1}{2}(4^-)$$

OMITTED FROM SUMMARY TABLE
Needs confirmation. **$K_4(2500)$ 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. **$K_4(2500)$ 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. **$K_4(2500)$ DECAY MODES**

Mode	
Γ_1 $p \bar{\Lambda}$	

 $K_4(2500)$ REFERENCES

CLELAND	81	NP B184 1	W.E. Cleland <i>et al.</i>	(PITT, GEVA, LAUS+)

NODE=M098

NODE=M098

NODE=M098M

NODE=M098M

NODE=M098M;LINKAGE=E

NODE=M098W

NODE=M098W

NODE=M098W;LINKAGE=E

NODE=M098215;NODE=M098

DESIG=1

NODE=M098220

NODE=M098R1
NODE=M098R1

NODE=M098

REFID=40262
REFID=22462

NODE=M091

NODE=M091

NODE=M091M

NODE=M091M

NODE=M091M;LINKAGE=R

NODE=M091W

NODE=M091W

NODE=M091W;LINKAGE=R

NODE=M091215;NODE=M091

DESIG=1

NODE=M091

REFID=22851

$K(3100)$

$$I^G(J^{PC}) = ?^?(?^{??})$$

NODE=M129

OMITTED FROM SUMMARY TABLE

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

 $K(3100)$ MASS

NODE=M129205

VALUE (MeV)

DOCUMENT ID

 ≈ 3100 OUR ESTIMATE

NODE=M129M

→ UNCHECKED ←

3-BODY DECAYS

NODE=M129M1

NODE=M129M1

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 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

OCCUR=2

OCCUR=3

OCCUR=4

4-BODY DECAYS

NODE=M129M2

NODE=M129M2

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 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

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

NODE=M129M3

NODE=M129M3

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=M129M;LINKAGE=A

 $K(3100)$ WIDTH

NODE=M129210

3-BODY DECAYS

NODE=M129W1

NODE=M129W1

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 $K(3100) \rightarrow \bar{\Lambda}p\pi^-$

OCCUR=2

 50 ± 18 ² ALEEV 93 BIS2 $K(3100) \rightarrow \Lambda\bar{p}\pi^-$

OCCUR=3

 30 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^+$

OCCUR=4

4-BODY DECAYS

NODE=M129W2

NODE=M129W2

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 $K(3100) \rightarrow \Lambda\bar{p}\pi^+\pi^-$

OCCUR=2

 32 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^-$

OCCUR=3

 30 ± 15 ² ALEEV 93 BIS2 $K(3100) \rightarrow \bar{\Lambda}p\pi^-\pi^+$

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

NODE=M129W3

NODE=M129W3

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=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 ($C = \pm 1$)

 $D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d,$ similarly for D^{*} 's

NODE=MXXX035

NODE=MXXX035

NODE=M061

 $D^*(2007)^0$
 $I(J^P) = \frac{1}{2}(1^-)$
 I, J, P need confirmation.
 J consistent with 1, value 0 ruled out (NGUYEN 77).

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

 $m_{D^*(2007)^0} - m_{D^0}$

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.			
$142.007 \pm 0.015 \pm 0.014$	10k	² TOMARADZE 15	CLEO	$e^+ e^- \rightarrow$ hadrons
$142.2 \pm 0.3 \pm 0.2$	145	ALBRECHT 95F	ARG	$e^+ e^- \rightarrow$ hadrons
$142.12 \pm 0.05 \pm 0.05$	1176	BORTOLETTO92B	CLE2	$e^+ e^- \rightarrow$ 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		³ GOLDHABER 77	MRK1	$e^+ e^-$

NODE=M061DM

² 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 $D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$.

³ From simultaneous fit to $D^*(2010)^+$, $D^*(2007)^0$, D^+ , and D^0 .

$D^*(2007)^0$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	⁴ ABACHI	88B HRS	$D^{*0} \rightarrow D^+ \pi^-$

⁴ Assuming $m_{D^{*0}} = 2007.2 \pm 2.1 \text{ MeV}/c^2$.

$D^*(2007)^0$ DECAY MODES

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^0$	$(64.7 \pm 0.9) \%$
$\Gamma_2 \quad D^0 \gamma$	$(35.3 \pm 0.9) \%$

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.

$$x_2 \quad \begin{vmatrix} -100 \\ x_1 \end{vmatrix}$$

$D^*(2007)^0$ BRANCHING RATIOS

$\Gamma(D^0 \pi^0)/\Gamma(D^0 \gamma)$ Γ_1/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.83 ± 0.07 OUR FIT	Error includes scale factor of 1.1.			
1.85 ± 0.07 OUR AVERAGE				
$1.90 \pm 0.07 \pm 0.05$	4.9k	ABLIKIM	15B BES3	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$
$1.74 \pm 0.02 \pm 0.13$		AUBERT,BE	05G BABR	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$

$\Gamma(D^0 \pi^0)/\Gamma_{\text{total}}$ Γ_1/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.647±0.009 OUR FIT				
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.655±0.008±0.005	3.2k	⁵ ABLIKIM	15B BES3	e ⁺ e ⁻ → hadrons
0.635±0.003±0.017	69k	⁵ AUBERT,BE	05G BABR	10.6 e ⁺ e ⁻ → hadrons
0.596±0.035±0.028	858	⁶ ALBRECHT	95F ARG	e ⁺ e ⁻ → hadrons
0.636±0.023±0.033	1097	⁶ BUTLER	92 CLE2	e ⁺ e ⁻ → hadrons

$\Gamma(D^0 \gamma)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.353 ± 0.009 OUR FIT				
0.381 ± 0.029 OUR AVERAGE				
$0.404 \pm 0.035 \pm 0.028$	456	⁶ ALBRECHT	95F ARG	$e^+ e^- \rightarrow \text{hadrons}$
$0.364 \pm 0.023 \pm 0.033$	621	⁶ BUTLER	92 CLE2	$e^+ e^- \rightarrow \text{hadrons}$
$0.37 \pm 0.08 \pm 0.08$		ADLER	88D MRK3	$e^+ e^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.345 \pm 0.008 \pm 0.005$	1.8k	⁵ ABLIKIM	15B BES3	$e^+ e^- \rightarrow \text{hadrons}$
$0.365 \pm 0.003 \pm 0.017$	68k	⁵ AUBERT,BE	05G BABR	$10.6 \text{ } e^+ e^- \rightarrow \text{hadrons}$
0.47 ± 0.23		LOW	87 HRS	$29 \text{ GeV } e^+ e^-$
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	$e^+ e^-$

NODE=M061DM;LINKAGE=A

NODE=M061DM;LINKAGE=G

NODE=M061W

NODE=M061W

NODE=M061W;LINKAGE=A

NODE=M061220;NODE=M061

NODE=M061

DESIG=1

DESIG=2

NODE=M061225

NODE=M061R3
NODE=M061R3

NODE=M061R2
NODE=M061R2

NODE=M061R1
NODE=M061R1

⁵ 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%

⁶ The BUTLER 92 and ALBRECHT 95F branching ratios are not independent, they have been constrained by the authors to sum to 100%.

NODE=M061R;LINKAGE=AU

NODE=M061R;LINKAGE=A

$D^*(2007)^0$ REFERENCES

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.)
NGUYEN	77	PRL 39 262	H.K. Nguyen <i>et al.</i>	(LBL, SLAC) J

NODE=M061

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
REFID=11543

NODE=M062

$D^*(2010)^\pm$

$I(J^P) = \frac{1}{2}(1^-)$
 I, J, P need confirmation.

$D^*(2010)^\pm$ 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.

NODE=M062M

NODE=M062M

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 GOLDHABER 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

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 $e^+e^- \rightarrow$ hadrons
140.64 ± 0.08 ± 0.06	620	BORTOLETTO92B	CLE2	$e^+e^- \rightarrow$ 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

145.4257 ± 0.0017 OUR 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 $D^{*\pm} \rightarrow D^0\pi^\pm \rightarrow (K\pi, K3\pi)\pi^\pm$
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	³ ADINOLFI 99	BEAT	$D^{*\pm} \rightarrow D^0\pi^\pm$
145.45 ± 0.02		³ BREITWEG 99	ZEUS	$D^{*\pm} \rightarrow D^0\pi^\pm \rightarrow (K\pi)\pi^\pm$

NODE=M062DM

OCCUR=3

145.42	±0.05		³ BREITWEG	99	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 3\pi) \pi^\pm$	OCCUR=2
145.5	±0.15	103	⁴ ADLOFF	97B	H1	$D^{*\pm} \rightarrow D^0 \pi^\pm$	
145.44	±0.08	152	⁴ BREITWEG	97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$	
145.42	±0.11	199	⁴ BREITWEG	97	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$	OCCUR=2
145.4	±0.2	48	⁴ 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	⁴ ALEXANDER	91B	OPAL	$D^{*\pm} \rightarrow D^0 \pi^\pm$	
145.30	±0.06		⁴ 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	$D^{*\pm} \rightarrow D^0 \pi^\pm$	OCCUR=2
145.5	±0.3	60	FITCH	81	SPEC	$\pi^- A$	
145.3	±0.5	30	FELDMAN	77B	MRK1	$D^{*+} \rightarrow D^0 \pi^+$	
• • • 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	$D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-) \pi^\pm$	OCCUR=2
145.44	±0.09	122	⁴ BREITWEG	97B	ZEUS	$D^{*\pm} \rightarrow D^0 \pi^\pm,$	
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	$D^{*\pm} \rightarrow D^0 \pi^\pm$	OCCUR=3
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	
³ Statistical errors only.							
⁴ Systematic error not evaluated.							

$m_{D^*(2010)^+} - m_{D^*(2007)^0}$

VALUE (MeV) DOCUMENT ID TECN COMMENT

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

2.6±1.8 ⁵ PERUZZI 77 LGW $e^+ e^-$

⁵ Not independent of FELDMAN 77B mass difference above, PERUZZI 77 D^0 mass, and GOLDHABER 77 $D^*(2007)^0$ mass.

$D^*(2010)^\pm$ WIDTH

VALUE (keV) CL% EVTS DOCUMENT ID TECN COMMENT

83.4±1.8 OUR AVERAGE

83.3±1.2± 1.4 312.8k ⁶ LEES 13X BABR $D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi, K 3\pi) \pi^\pm$

96 ±4 ±22 ⁶ ANASTASSOV 02 CLE2 $D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K \pi) \pi^\pm$

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

83.4±1.7± 1.5 138.5k ⁶ LEES 13X BABR $D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- \pi^+) \pi^\pm$

83.2±1.5± 2.6 174.3k ⁶ LEES 13X BABR $D^{*\pm} \rightarrow D^0 \pi^\pm \rightarrow (K^- 2\pi^+ \pi^-) \pi^\pm$

<131 90 110 BARLAG 92B ACCM $\pi^- 230 \text{ GeV}$

⁶ Ignoring the electromagnetic contribution from $D^{*\pm} \rightarrow D^\pm \gamma$.

$D^*(2010)^\pm$ DECAY MODES

$D^*(2010)^-$ modes are charge conjugates of the modes below.

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) %

NODE=M062DM;LINKAGE=AV
NODE=M062DM;LINKAGE=A

NODE=M062EM

NODE=M062EM

NODE=M062EM;LINKAGE=P

NODE=M062W

NODE=M062W

OCCUR=3

OCCUR=2

NODE=M062W;LINKAGE=LE

NODE=M062225;NODE=M062

NODE=M062

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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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	-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						
0.677 $\pm$ 0.006 OUR AVERAGE						
0.6759 $\pm$ 0.0029 $\pm$ 0.0064	7,8,9	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	7	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	9	GOLDHABER	77	MRK1	$e^+ e^-$	

NODE=M062R1
NODE=M062R1

$\Gamma(D^+ \pi^0) / \Gamma_{\text{total}}$						Γ_2 / Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.307 $\pm$ 0.005 OUR FIT						
0.3073 $\pm$ 0.0013 $\pm$ 0.0062						
	7,8,9	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	7 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	$e^+ e^-$	

NODE=M062R3
NODE=M062R3

$\Gamma(D^+\gamma)/\Gamma_{\text{total}}$						Γ_3/Γ
VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	
0.016 ±0.004 OUR FIT						
0.016 ±0.005 OUR AVERAGE						
0.0168±0.0042±0.0029			7,8 BARTELT	98	CLE2	e^+e^-
0.011 ±0.014 ±0.016		12	7 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 ±0.05 ±0.05			ADLER	88D	MRK3	e^+e^-
0.22 ±0.12			10 COLES	82	MRK2	e^+e^-

NODE=M062R2
NODE=M062R2

⁷ The branching ratios are not independent, they have been constrained by the authors to sum to 100%.

⁸ Systematic error includes theoretical error on the prediction of the ratio of hadronic modes.

⁹ Assuming that isospin is conserved in the decay.

¹⁰ Not independent of $\Gamma(D^0 \pi^+) / \Gamma_{\text{total}}$ and $\Gamma(D^+ \pi^0) / \Gamma_{\text{total}}$ measurement.

NODE=M062R;LINKAGE=A

NODE=M062R;LINKAGE=B

NODE=M062R;LINKAGE=G

NODE=M062R;LINKAGE=C

$D^*(2010)^\pm$ REFERENCES

LEES	17F	PRL 119 202003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13X	PRL 111 111801	J.P. Lees <i>et al.</i>	(BABAR Collab.)
Also		PR D88 052003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
Also		PR D88 079902 (errat.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ANASTASSOV	02	PR D65 032003	A. Anastassov <i>et al.</i>	(CLEO Collab.)
ADINOLFI	99	NP B547 3	M. Adinolfi <i>et al.</i>	(Beatrice Collab.)
BREITWEG	99	EPJ C6 67	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BARTELT	98	PRL 80 3919	J. Bartelt <i>et al.</i>	(CLEO Collab.)
ADLOFF	97B	ZPHY C72 593	C. Adloff <i>et al.</i>	(H1 Collab.)
BREITWEG	97	PL B401 192	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
BREITWEG	97B	PL B407 402	J. Breitweg <i>et al.</i>	(ZEUS Collab.)
ALBRECHT	95F	ZPHY C66 63	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DERRICK	95	PL B349 225	M. Derrick <i>et al.</i>	(ZEUS Collab.)
BARLAG	92B	PL B278 480	S. Barlag <i>et al.</i>	(ACCMOR 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.)
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.)

NODE=M062

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REFID=11435

$D_0^*(2300)^0$ $I(J^P) = \frac{1}{2}(0^+)$
was $D_0^*(2400)^0$
 $J^P = 0^+$ assignment favored (ABE 04D).

NODE=M178

NODE=M178

 $D_0^*(2300)^0$ MASS

NODE=M178M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2300±19 OUR AVERAGE				
2297± 8±20	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2308±17±32		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2407±21±35	9.8k	¹ LINK	04A FOCS	γA
¹ Possibly the feed-down from another state.				

NODE=M178M

NODE=M178M;LINKAGE=A

 $D_0^*(2300)^0$ WIDTH

NODE=M178W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
274±40 OUR AVERAGE				
273±12±48	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
276±21±63		ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
240±55±59	9.8k	² LINK	04A FOCS	γA
² Possibly the feed-down from another state.				

NODE=M178W

NODE=M178W;LINKAGE=A

 $D_0^*(2300)^0$ DECAY MODES

NODE=M178215;NODE=M178

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 D^+ \pi^-$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D_0^*(2300)^0$ REFERENCES

NODE=M178

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=52941
REFID=50011
REFID=49775

$D_0^*(2300)^\pm$

$$I(J^P) = \frac{1}{2}(0^+)$$

OMITTED FROM SUMMARY TABLE
was $D_0^*(2400)^\pm$
 J, P need confirmation.

NODE=M179

NODE=M179

 $D_0^*(2300)^\pm$ MASS

NODE=M179M

NODE=M179M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2349 ± 7 OUR AVERAGE				
2360 ± 15 ± 30		¹ AAIJ	15X LHCb	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2349 ± 6 ± 4		² AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
• • • 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 FOCUS	γA
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.				

OCCUR=2

NODE=M179M;LINKAGE=A

NODE=M179M;LINKAGE=B

NODE=M179M;LINKAGE=C

NODE=M179M;LINKAGE=D

 $D_0^*(2300)^\pm$ WIDTH

NODE=M179W

NODE=M179W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
221 ± 18 OUR AVERAGE				
255 ± 26 ± 51		¹ AAIJ	15X LHCb	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
217 ± 13 ± 13		² AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
230 ± 15 ± 21		³ AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
283 ± 24 ± 34	18.8k	⁴ LINK	04A FOCUS	γA
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.				

OCCUR=2

NODE=M179W;LINKAGE=A

NODE=M179W;LINKAGE=B

NODE=M179W;LINKAGE=C

NODE=M179W;LINKAGE=D

 $D_0^*(2300)^\pm$ DECAY MODES

NODE=M179215;NODE=M179

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^0 \pi^+$	seen

DESIG=1;OUR EVAL;→ UNCHECKED ←

 $D_0^*(2300)^\pm$ REFERENCES

NODE=M179

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.)
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS Collab.)

REFID=56588

REFID=56609

REFID=49775

$D_1(2420)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

NODE=M097

 $D_1(2420)^0$ MASS

NODE=M097M

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=M097M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2421.8±0.6 OUR FIT	Error includes scale factor of 1.8. [2420.8 ± 0.5 MeV OUR 2020 FIT Scale factor = 1.3]			
2421.8±0.8 OUR AVERAGE	Error includes scale factor of 2.2. See the ideogram below. [2420.5 ± 0.6 MeV OUR 2020 AVERAGE Scale factor = 1.3]			
2424.8±0.1±0.7	79k	¹ AAIJ	20D LHCB	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2419.6±0.1±0.7	210k	AAIJ	13CC LHCB	$p p \rightarrow D^{*+} \pi^- X$
2423.1±1.5 ^{+0.4} _{-1.0}	2.7k	² ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2420.1±0.1±0.8	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2426 ±3 ±1	151	ABE	05A BELL	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
2421.4±1.5±0.9		³ ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
2421 ⁺¹ ₋₂ ±2	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2422 ±2 ±2	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
2428 ±3 ±2	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2414 ±2 ±5	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2428 ±8 ±5	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
2420.5±2.1±0.9	3110 ± 340	⁴ CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
2421.7±0.7±0.6	7.5k	ABULENCIA	06A CDF	1900 $p \bar{p} \rightarrow D^{*+} \pi^- X$
2425 ±3	235	⁵ ABREU	98M DLPH	$e^+ e^-$

NODE=M097M

NEW

NEW

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 $D_1^*(2430)^0$.

⁴ 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.

⁵ No systematic error given.

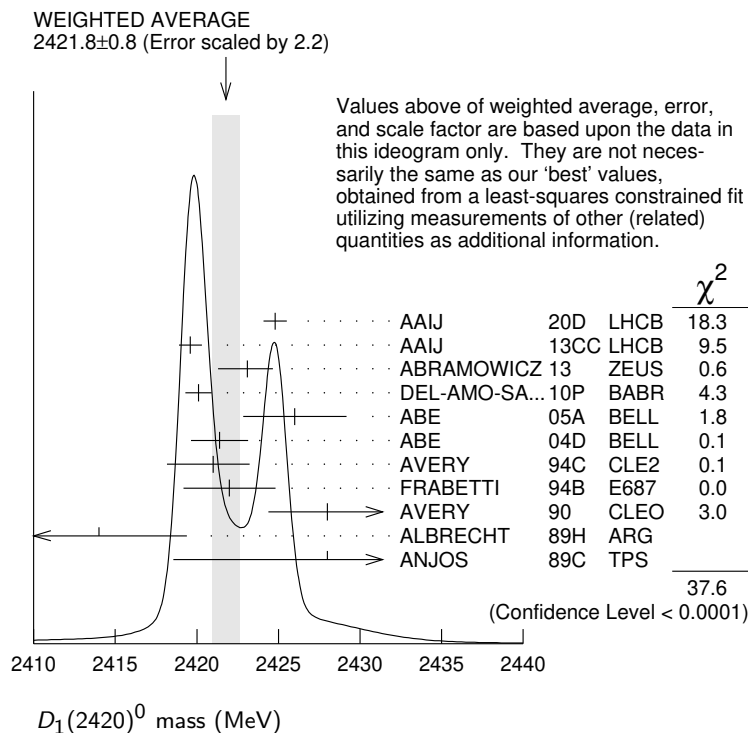
NODE=M097M;LINKAGE=B

NODE=M097M;LINKAGE=AR

NODE=M097M;LINKAGE=AB

NODE=M097M;LINKAGE=CH

NODE=M097M;LINKAGE=K



$$m_{D_1^0} - m_{D^{*+}}$$

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=M097DM

NODE=M097DM

NODE=M097DM

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
411.5±0.6 OUR FIT	Error includes scale factor of 1.7. [410.6 ± 0.5 MeV OUR 2020 FIT Scale factor = 1.3]			
411.5±0.8 OUR AVERAGE				
410.2±2.1±0.9	3110 ± 340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
411.7±0.7±0.4	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$

$D_1(2420)^0$ WIDTH

NODE=M097W

NODE=M097W

NEW

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
31.8± 2.2 OUR AVERAGE	Error includes scale factor of 3.1. See the ideogram below. [31.7 ± 2.5 MeV OUR 2020 AVERAGE Scale factor = 3.5]			
33.6± 0.3± 2.7	79k	¹ AAIJ	20D LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
35.2± 0.4± 0.9	210k	AAIJ	13CC LHCb	$pp \rightarrow D^{*+} \pi^- X$
38.8± 5.0 ⁺ _{-1.9} 5.4	2.7k	² ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
31.4± 0.5± 1.3	103k	DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^{*+} \pi^- X$
20.0± 1.7± 1.3	7.5k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^{*+} \pi^- X$
24 ± 7 ± 8	151	ABE	05A BELL	$B^- \rightarrow D^0 \pi^+ \pi^- \pi^-$
23.7± 2.7± 4.0		³ ABE	04D BELL	$B^- \rightarrow D^{*+} \pi^- \pi^-$
20 ⁺ ₋₆ ± 3	286	AVERY	94C CLE2	$e^+ e^- \rightarrow D^{*+} \pi^- X$
15 ± 8 ± 4	51	FRABETTI	94B E687	$\gamma Be \rightarrow D^{*+} \pi^- X$
23 ⁺ ₋₆ ⁸ ₋₃ ¹⁰ ₋₃	279	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
13 ± 6 ⁺ ₋₅ ¹⁰ ₋₅	171	ALBRECHT	89H ARG	$e^+ e^- \rightarrow D^{*+} \pi^- X$

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

53.2± 7.2 ⁺ _{-4.9} ^{3.3} _{-4.9}	3110 ± 340	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{*+} \pi^- X$
58 ± 14 ± 10	171	ANJOS	89C TPS	$\gamma N \rightarrow D^{*+} \pi^- X$

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.

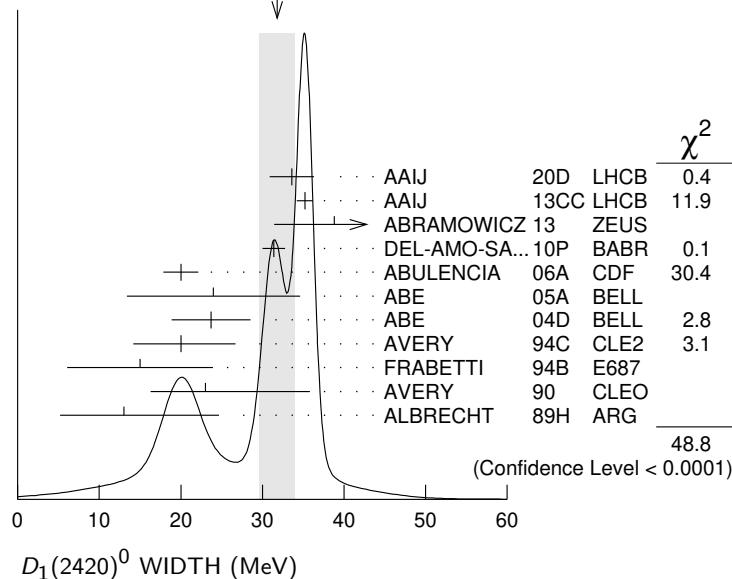
³ Fit includes the contribution from $D_1^*(2430)^0$.

NODE=M097W;LINKAGE=B

NODE=M097W;LINKAGE=AR

NODE=M097W;LINKAGE=AB

WEIGHTED AVERAGE
31.8±2.2 (Error scaled by 3.1)



$D_1(2420)^0$ DECAY MODES

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+}(2010)\pi^-$	seen
Γ_2 $D^0\pi^+\pi^-$	seen
Γ_3 $D^0\rho^0$	
Γ_4 $D^0f_0(500)$	
Γ_5 $D_0^{*+}(2300)\pi^-$	
Γ_6 $D^+\pi^-$	not seen
Γ_7 $D^{*0}\pi^+\pi^-$	not seen

NODE=M097215;NODE=M097

NODE=M097

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

DESIG=5

DESIG=6

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

 $D_1(2420)^0$ BRANCHING RATIOS

$\Gamma(D^{*+}(2010)\pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ACKERSTAFF 97W OPAL $e^+e^- \rightarrow D^{*+}\pi^-X$
seen	AVERY 90 CLEO $e^+e^- \rightarrow D^{*+}\pi^-X$
seen	ALBRECHT 89H ARG $e^+e^- \rightarrow D^{*+}\pi^-X$
seen	ANJOS 89C TPS $\gamma N \rightarrow D^{*+}\pi^-X$

NODE=M097220

NODE=M097R1
NODE=M097R1

$\Gamma(D^+\pi^-)/\Gamma(D^{*+}(2010)\pi^-)$	Γ_6/Γ_1
VALUE CL%	DOCUMENT ID TECN COMMENT
<0.24 90	AVERY 90 CLEO $e^+e^- \rightarrow D^+\pi^-X$

NODE=M097R2
NODE=M097R2 **$D_1(2420)^0$ POLARIZATION AMPLITUDE A_{D_1}**

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 $D^{*} \rightarrow D\pi$.

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

NODE=M097PAH

NODE=M097PAH

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
5.73±0.25 OUR AVERAGE				
7.8 $^{+6.7}_{-2.7}$ $^{+4.6}_{-1.8}$	2.7k	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^-X$
5.72±0.25	103k	DEL-AMO-SA...10P	BABR	$e^+e^- \rightarrow D^{*+}\pi^-X$
5.9 $^{+3.0}_{-1.7}$ $^{+2.4}_{-1.0}$		CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{*+}\pi^-X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3.30±0.48	210k	² AAIJ	13CC LHCB	$pp \rightarrow D^{*+}\pi^-X$
3.8 ±0.6 ±0.8		³ AUBERT	09Y BABR	$B^+ \rightarrow D_1^0 \ell^+ \nu_\ell$
2.74 $^{+1.40}_{-0.93}$		⁴ AVERY	94C CLE2	$e^+e^- \rightarrow D^{*+}\pi^-X$

NODE=M097PAH

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.

² Systematic uncertainty not estimated. Resonance parameters fixed.

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.

⁴ Systematic uncertainties not estimated.

NODE=M097PAH;LINKAGE=AR

NODE=M097PAH;LINKAGE=A
NODE=M097PAH;LINKAGE=AU

NODE=M097PAH;LINKAGE=AV

 $D_1(2420)^0$ REFERENCES

AAIJ 20D	PR D101 032005	R. Aaij <i>et al.</i>	(LHCb 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.)
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.)

NODE=M097

REFID=60253
REFID=55581
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REFID=41013
REFID=41001
REFID=40737

$D_1(2420)^\pm$
 $I(J^P) = \frac{1}{2}(?)$
 I needs confirmation.

OMITTED FROM SUMMARY TABLE

Seen in $D^*(2007)^0 \pi^+$. $J^P = 0^+$ ruled out.

NODE=M120

NODE=M120

NODE=M120M

NODE=M120M

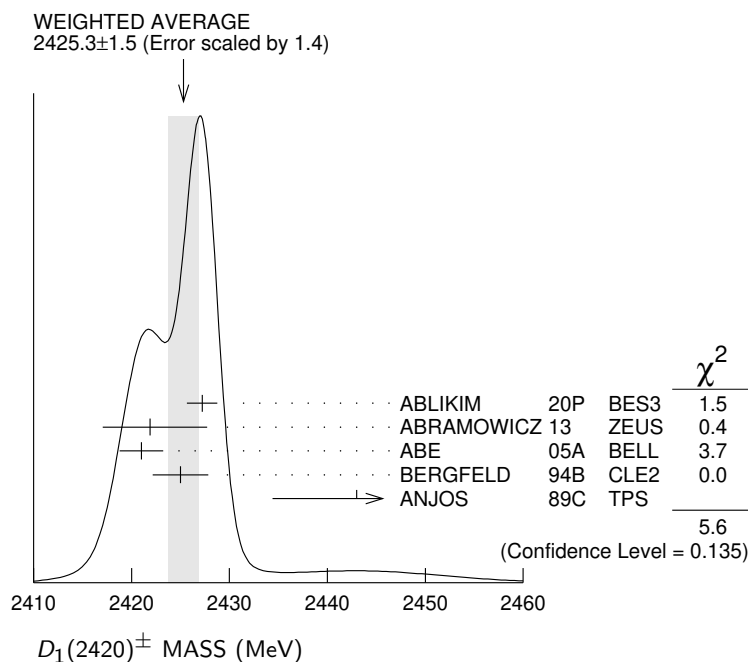
NEW

NODE=M120M;LINKAGE=AB

 $D_1(2420)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2425.3$\pm$1.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below. [2423.2 $\pm$ 2.4 MeV OUR 2020 AVERAGE Scale factor = 1.5]		
2427.2 $\pm$ 1.0 $\pm$ 1.2	4207	ABLIKIM	20P BES3	$e^+e^- \rightarrow D^+D^-\pi^+\pi^-$
2421.9 $\pm$ 4.7 $^{+3.4}_{-1.2}$	759	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0}\pi^+X$
2421 ± 2 ± 1	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+\pi^+\pi^-\pi^-$
2425 ± 2 ± 2	146	BERGFELD	94B CLE2	$e^+e^- \rightarrow D^{*0}\pi^+X$
2443 ± 7 ± 5	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0\pi^+X^0$

¹ 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.

 **$m_{D_1^*(2420)^\pm} = m_{D_1^*(2420)^0}$**

NODE=M120DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4$^{+2}_{-3}$ ± 3	BERGFELD	94B CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M120DM

 $D_1(2420)^\pm$ WIDTH

NODE=M120W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
23.7$\pm$ 2.9 OUR AVERAGE		[25 $\pm$ 6 MeV OUR 2020 AVERAGE]		
23.2 $\pm$ 2.3 $\pm$ 2.3	4207	ABLIKIM	20P BES3	$e^+e^- \rightarrow D^+D^-\pi^+\pi^-$
21 ± 5 ± 8	124	ABE	05A BELL	$\bar{B}^0 \rightarrow D^+\pi^+\pi^-\pi^-$
26 $^{+8}_{-7}$ ± 4	146	BERGFELD	94B CLE2	$e^+e^- \rightarrow D^{*0}\pi^+X$
41 ± 19 ± 8	190	ANJOS	89C TPS	$\gamma N \rightarrow D^0\pi^+X^0$

NODE=M120W

NEW

$D_1(2420)^\pm$ DECAY MODES

$D_1^*(2420)^-$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^*(2007)^0 \pi^+$	seen
Γ_2 $D^+ \pi^+ \pi^-$	seen
Γ_3 $D^+ \rho^0$	
Γ_4 $D^+ f_0(500)$	
Γ_5 $D_0^*(2300)^0 \pi^+$	
Γ_6 $D^0 \pi^+$	not seen
Γ_7 $D^{*+} \pi^+ \pi^-$	not seen

NODE=M120215;NODE=M120

NODE=M120

DESIG=1

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4

DESIG=5

DESIG=6

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=7;OUR EST;→ UNCHECKED ←

 $D_1(2420)^\pm$ BRANCHING RATIOS

$\Gamma(D^*(2007)^0 \pi^+)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	ANJOS 89C TPS $\gamma N \rightarrow D^0 \pi^+ \chi^0$

NODE=M120220

NODE=M120R1

NODE=M120R1

$\Gamma(D^0 \pi^+)/\Gamma(D^*(2007)^0 \pi^+)$	Γ_6/Γ_1
VALUE	CL% DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
<0.18	90 BERGFELD 94B CLE2 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M120R2

NODE=M120R2

 $D_1(2420)^\pm$ POLARIZATION AMPLITUDE A_{D_1}

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 $D^* \rightarrow D \pi$.

Unpolarized D_1 decaying purely via D -wave is predicted to give $A_{D_1} = 3$.

VALUE	DOCUMENT ID TECN COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •	
$3.8 \pm 0.6 \pm 0.8$	² AUBERT 09Y BABR $B^0 \rightarrow D_1^- \ell^+ \nu_\ell$

NODE=M120PAH

NODE=M120PAH

² 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=M120PAH

NODE=M120PAH;LINKAGE=AU

 $D_1(2420)^\pm$ REFERENCES

ABLIKIM 20P PL B804 135395	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABRAMOWICZ 13 NP B866 229	H. Abramowicz <i>et al.</i>	(ZEUS Collab.)
AUBERT 09Y PRL 103 051803	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE 05A PRL 94 221805	K. Abe <i>et al.</i>	(BELLE Collab.)
BERGFELD 94B PL B340 194	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
ANJOS 89C PRL 62 1717	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)

NODE=M120

REFID=60395

REFID=54743

REFID=52929

REFID=50755

REFID=44099

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

NEW

NODE=M180M;LINKAGE=A
NODE=M180M;LINKAGE=AU

NODE=M180W

NODE=M180W
NEWNODE=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 [2427 ± 40 MeV OUR 2020 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 [384 ⁺¹³⁰ ₋₁₁₀ MeV OUR 2020 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.)

$$D_2^*(2460)^0$$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored (ALBRECHT 89B, ALBRECHT 89H), natural parity confirmed by the helicity analysis (DEL-AMO-SANCHEZ 10P). AAIJ 13CC confirms $J^P = 2^+$ and natural parity.

NODE=M119

NODE=M119

$D_2^*(2460)^0$ MASS

NODE=M119M

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=M119M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2460.7 $\pm$ 0.4 OUR FIT	Error includes scale factor of 2.9. [2460.7 $\pm$ 0.4 MeV OUR 2020 FIT Scale factor = 3.1]			
2460.58 $\pm$ 0.34 OUR AVERAGE	Error includes scale factor of 2.5. See the ideogram below. [2460.56 $\pm$ 0.35 MeV OUR 2020 AVERAGE Scale factor = 2.6]			
2463.7 $\pm$ 0.4 $\pm$ 0.7	28k	¹ AAIJ	16AH LHCB	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.0 $\pm$ 1.4 $\pm$ 0.5	2k	² AAIJ	15V LHCB	$B^- \rightarrow D^+ K^- \pi^-$
2460.4 $\pm$ 0.4 $\pm$ 1.2	82k	AAIJ	13CC LHCB	$pp \rightarrow D^{*+} \pi^- X$
2460.4 $\pm$ 0.1 $\pm$ 0.1	675k	AAIJ	13CC LHCB	$pp \rightarrow D^+ \pi^- X$
2462.5 $\pm$ 2.4 $^{+1.3}_{-1.1}$	2.3k	³ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2462.2 $\pm$ 0.1 $\pm$ 0.8	243k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
2460.4 $\pm$ 1.2 $\pm$ 2.2	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
2461.6 $\pm$ 2.1 $\pm$ 3.3		⁴ ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
2464.5 $\pm$ 1.1 $\pm$ 1.9	5.8k	⁴ LINK	04A FOCUS	γA
2465 $\pm$ 3 $\pm$ 3	486	AVERY	94C CLE2	$e^+ e^- \rightarrow D^+ \pi^- X$
2453 $\pm$ 3 $\pm$ 2	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^+ \pi^- X$
2461 $\pm$ 3 $\pm$ 1	440	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
2455 $\pm$ 3 $\pm$ 5	337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
2459 $\pm$ 3 $\pm$ 2	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+ \pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2469.1 $\pm$ 3.7 $^{+1.2}_{-1.3}$	1.5k	⁵ CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
2463.3 $\pm$ 0.6 $\pm$ 0.8	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$
2461 $\pm$ 6	126	⁶ ABREU	98M DLPH	$e^+ e^-$
2466 $\pm$ 7	1	ASRATYAN	95 BEBC	53,40 $\nu(\bar{\nu}) \rightarrow pX, dX$

NODE=M119M

NEW

NEW

OCCUR=2

OCCUR=2

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.

NODE=M119M;LINKAGE=B

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.

NODE=M119M;LINKAGE=A

³ 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.

NODE=M119M;LINKAGE=AR

⁴ Fit includes the contribution from $D_0^*(2400)^0$.

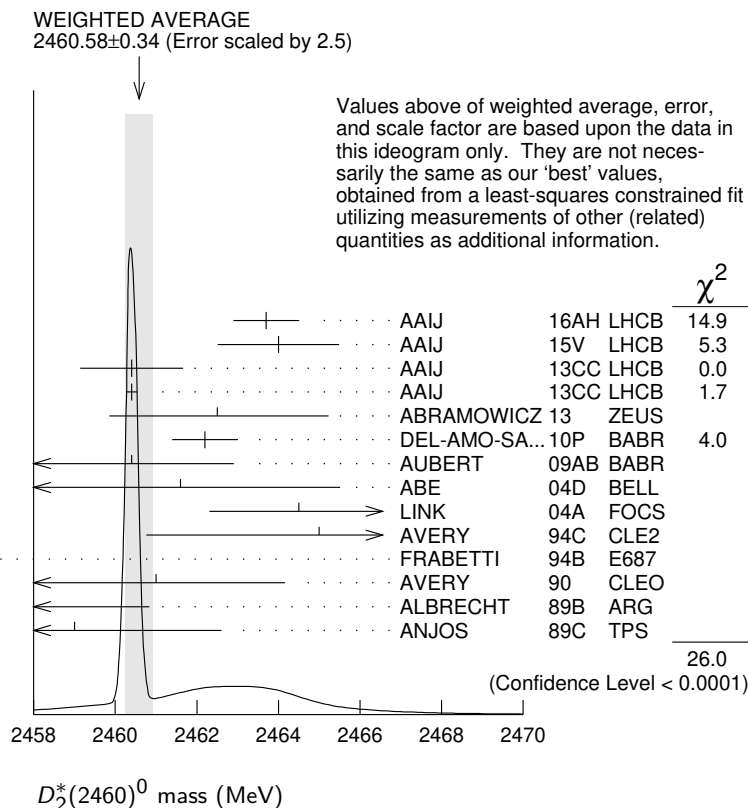
NODE=M119M;LINKAGE=LI

⁵ 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.

NODE=M119M;LINKAGE=CH

⁶ No systematic error given.

NODE=M119M;LINKAGE=K



$m_{D_2^{*0}} - m_{D^+}$

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=M119DM

NODE=M119DM

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
591.0±0.4 OUR FIT	Error includes scale factor of 2.8.	[591.0 ± 0.4 MeV OUR 2020 FIT Scale factor = 2.9]		
593.9±0.6±0.5	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$

NODE=M119DM

NEW

$m_{D_2^{*0}} - m_{D^{*+}}$

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=M119DM2

NODE=M119DM2

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
450.4±0.4 OUR FIT	Error includes scale factor of 2.8.	[450.4 ± 0.4 MeV OUR 2020 FIT Scale factor = 2.9]		
458.8±3.7^{+1.2}_{-1.3}	1560 ± 230	CHEKANOV	09 ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$

NODE=M119DM2

NEW

$D_2^*(2460)^0$ WIDTH

NODE=M119W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
47.4± 1.0 OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.	[47.5 ± 1.1 MeV OUR 2020 AVERAGE Scale factor = 1.8]		
47.0± 0.8± 1.0	28k	⁷ AAIJ	16AH LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
43.8± 2.9± 1.8	2k	⁸ AAIJ	15V LHCb	$B^- \rightarrow D^+ K^- \pi^-$
43.2± 1.2± 3.0	82k	AAIJ	13CC LHCb	$p\bar{p} \rightarrow D^{*+} \pi^- X$
45.6± 0.4± 1.1	675k	AAIJ	13CC LHCb	$p\bar{p} \rightarrow D^+ \pi^- X$
46.6± 8.1 ^{+5.9} _{-3.8}	2.3k	⁹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+} \pi^- X$
50.5± 0.6± 0.7	243k	DEL-AMO-SA..10P	BABR	$e^+ e^- \rightarrow D^+ \pi^- X$
41.8± 2.5± 2.9	3.4k	AUBERT	09AB BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
49.2± 2.3± 1.3	20k	ABULENCIA	06A CDF	1900 $p\bar{p} \rightarrow D^+ \pi^- X$

NODE=M119W

NEW

OCCUR=3

OCCUR=2

45.6 ± 4.4 ± 6.7		10 ABE	04D BELL	$B^- \rightarrow D^+ \pi^- \pi^-$
38.7 ± 5.3 ± 2.9	5.8k	10 LINK	04A FOCS	γA
28 $\pm \frac{8}{7} \pm 6$	486	AVERY	94C CLE2	$e^+ e^- \rightarrow D^+ \pi^- X$
25 ± 10 ± 5	128	FRABETTI	94B E687	$\gamma Be \rightarrow D^+ \pi^- X$
20 $\pm \frac{9}{12} \pm \frac{9}{10}$	440	AVERY	90 CLEO	$e^+ e^- \rightarrow D^{*+} \pi^- X$
15 $\pm \frac{13}{10} \pm \frac{5}{10}$	337	ALBRECHT	89B ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
20 ± 10 ± 5	153	ANJOS	89C TPS	$\gamma N \rightarrow D^+ \pi^- X$

⁷ 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.

⁸ 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.

⁹ 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.

¹⁰ Fit includes the contribution from $D_0^*(2400)^0$.

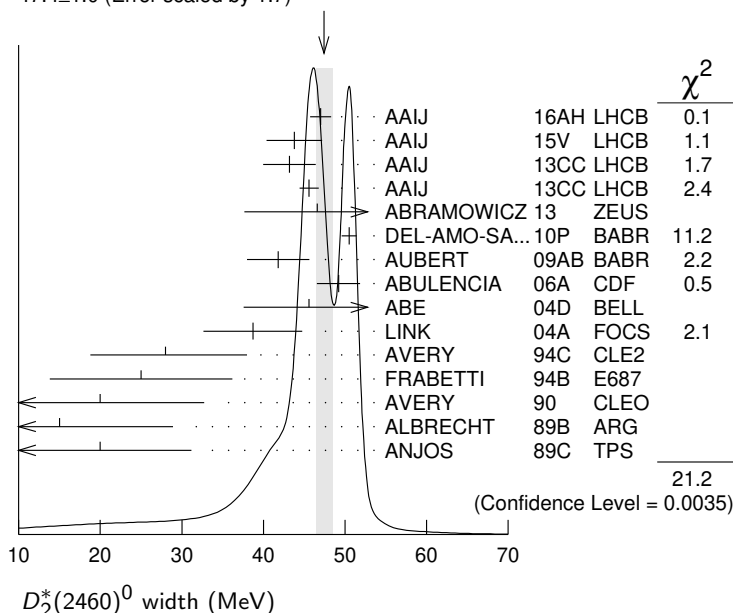
NODE=M119W;LINKAGE=D

NODE=M119W;LINKAGE=A

NODE=M119W;LINKAGE=AR

NODE=M119W;LINKAGE=LI

WEIGHTED AVERAGE
47.4 ± 1.0 (Error scaled by 1.7)



$D_2^*(2460)^0$ DECAY MODES

$\bar{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

NODE=M119215;NODE=M119

NODE=M119

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^+ \pi^-$	seen
Γ_2 $D^*(2010)^+ \pi^-$	seen
Γ_3 $D^0 \pi^+ \pi^-$	not seen
Γ_4 $D^{*0} \pi^+ \pi^-$	not seen

CLUMP=A;DESIG=1

DESIG=2

DESIG=3;OUR EST;→ UNCHECKED ←

DESIG=4;OUR EST;→ UNCHECKED ←

$D_2^*(2460)^0$ BRANCHING RATIOS

NODE=M119220

$\Gamma(D^+ \pi^-)/\Gamma_{\text{total}}$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
seen		3.4k	AUBERT	09AB	BABR	$B^- \rightarrow D^+ \pi^- \pi^-$
seen		337	ALBRECHT	89B	ARG	$e^+ e^- \rightarrow D^+ \pi^- X$
seen			ANJOS	89C	TPS	$\gamma N \rightarrow D^+ \pi^- X$

NODE=M119R1

NODE=M119R1

$\Gamma(D^*(2010)^+\pi^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ACKERSTAFF 97W	OPAL	$e^+e^- \rightarrow D^{*+}\pi^- X$
seen	AVERY 90	CLEO	$e^+e^- \rightarrow D^{*+}\pi^- X$
seen	ALBRECHT 89H	ARG	$e^+e^- \rightarrow D^*\pi^- X$

NODE=M119R2
 NODE=M119R2

 $\Gamma(D^+\pi^-)/\Gamma(D^*(2010)^+\pi^-)$ Γ_1/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.54±0.15 OUR AVERAGE				
1.4 ±0.3 ±0.3	2.3k	11 ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
1.47±0.03±0.16	379k	DEL-AMO-SA..10P	BABR	$e^+e^- \rightarrow D^{(*)+}\pi^- X$
2.8 ±0.8 $^{+0.5}_{-0.6}$	1560 ± 230	CHEKANOV 09	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
2.2 ±0.7 ±0.6		AVERY 94C	CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$
2.3 ±0.8		AVERY 90	CLEO	e^+e^-
3.0 ±1.1 ±1.5		ALBRECHT 89H	ARG	$e^+e^- \rightarrow D^*\pi^- X$

NODE=M119R3
 NODE=M119R3

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

1.9 ±0.5		ABE 04D	BELL	$B^- \rightarrow D^{(*)+}\pi^-\pi^-$
11 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 .				

NODE=M119R3;LINKAGE=AR

 $\Gamma(D^+\pi^-)/[\Gamma(D^+\pi^-) + \Gamma(D^*(2010)^+\pi^-)]$ $\Gamma_1/(\Gamma_1+\Gamma_2)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.62±0.03±0.02	8414	12 AUBERT 09Y	BABR	$B^+ \rightarrow D_2^{*0}\ell^+\nu_\ell$

NODE=M119R01
 NODE=M119R01

12 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.

NODE=M119R01;LINKAGE=AU

 $D_2^*(2460)^0$ POLARIZATION AMPLITUDE A_{D_2}

NODE=M119PAM

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 $D^* \rightarrow D\pi$.

NODE=M119PAM

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
-1.16±0.35	2.3k	13 ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)+}\pi^- X$
consistent with -1	243k	DEL-AMO-SA..10P	BABR	$e^+e^- \rightarrow D^+\pi^- X$
-0.74 $^{+0.49}_{-0.38}$		14 AVERY 94C	CLE2	$e^+e^- \rightarrow D^{*+}\pi^- X$

NODE=M119PAM

13 From the combined fit of the $M(D^+\pi^-)$ and $M(D^{*+}\pi^-)$ distributions.
 14 Systematic uncertainties not estimated.

NODE=M119PAM;LINKAGE=AB
 NODE=M119PAM;LINKAGE=AV

 $D_2^*(2460)^0$ REFERENCES

NODE=M119

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 (errata.)	R. Aaij <i>et al.</i>	(LHCb 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 09AB	PR D79 112004	B. Aubert <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 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.)
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.)
ASRATYAN 95	ZPHY C68 43	A.E. Asratyan <i>et al.</i>	(BIRM, BELG, CERN+)
AVERY 94C	PL B331 236	P. Avery <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 89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.) JP
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=57518
 REFID=56575
 REFID=57289
 REFID=55581
 REFID=54743
 REFID=53534
 REFID=52941
 REFID=52929
 REFID=52733
 REFID=51054
 REFID=50011
 REFID=49775
 REFID=46315
 REFID=45788
 REFID=44439
 REFID=44096
 REFID=43687
 REFID=41013
 REFID=40736
 REFID=41001
 REFID=40737

$D_2^*(2460)^\pm$

$$I(J^P) = \frac{1}{2}(2^+)$$

 $J^P = 2^+$ assignment strongly favored(ALBRECHT 89B).

NODE=M150

NODE=M150

NODE=M150M

NODE=M150M

 $D_2^*(2460)^\pm$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2465.4±1.3 OUR AVERAGE		Error includes scale factor of 3.1. See the ideogram below.		
2465.6±1.8±1.3		¹ AAIJ	15X LHCB	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
2468.6±0.6±0.3		² AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2463.1±0.2±0.6	342k	AAIJ	13CC LHCB	$p p \rightarrow D^0 \pi^+ X$
2460.6±4.4 ^{+3.6} _{-0.8}	1371	³ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
2465.4±0.2±1.1	111k	⁴ DEL-AMO-SA...10P	BABR	$e^+ e^- \rightarrow D^0 \pi^+ X$
2465.7±1.8 ^{+1.4} _{-4.8}	2909	KUZMIN	07 BELL	$e^+ e^- \rightarrow \text{hadrons}$
2463 ±3 ±3	310	BERGFELD	94B CLE2	$e^+ e^- \rightarrow D^0 \pi^+ X$
2453 ±3 ±2	185	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D^0 \pi^+ X$
2469 ±4 ±6		ALBRECHT	89F ARG	$e^+ e^- \rightarrow D^0 \pi^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2468.1±0.6±0.5		⁵ AAIJ	15Y LHCB	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
2467.6±1.5±0.8	3.5k	⁶ LINK	04A FOCS	γA

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 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 At a fixed width of 50.5 MeV.⁵ Modeling the $\pi^+\pi^-$ S-wave with the K-matrix formalism.⁶ Fit includes the contribution from $D_0^*(2400)^\pm$. Not independent of the corresponding mass difference measurement, $(m_{D_2^*(2460)^\pm} - (m_{D_2^*(2460)^0})$.

OCCUR=2

NODE=M150M;LINKAGE=A

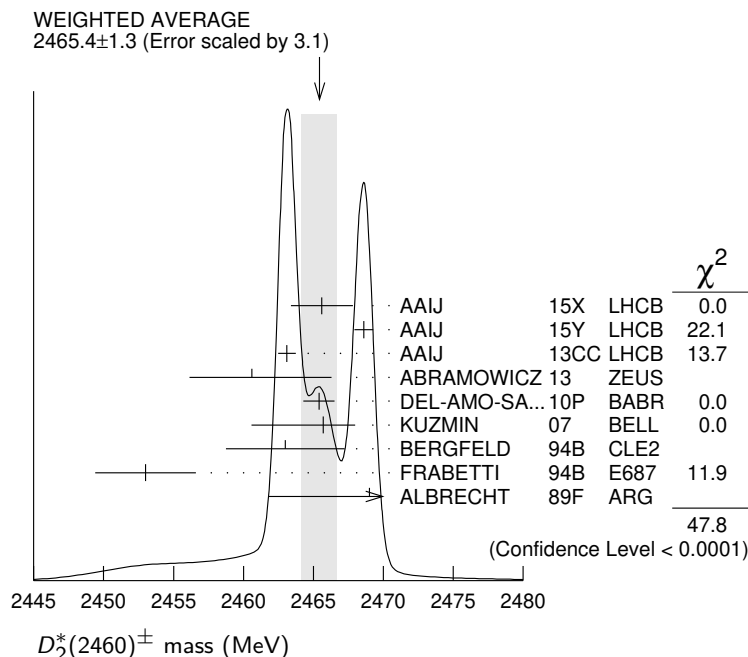
NODE=M150M;LINKAGE=B

NODE=M150M;LINKAGE=AB

NODE=M150M;LINKAGE=DE

NODE=M150M;LINKAGE=C

NODE=M150M;LINKAGE=LI



$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0}$

NODE=M150DM

NODE=M150DM

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	$\gamma \text{Be} \rightarrow D\pi X$
14 ±5 ±8	ALBRECHT	89F ARG	$e^+ e^- \rightarrow D^0 \pi^+ X$

$D_2^*(2460)^\pm$ WIDTH

NODE=M150W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
46.7$\pm$ 1.2 OUR AVERAGE				
46.0 $\pm$ 3.4 $\pm$ 3.2		¹ AAIJ	15X LHCb	$B^0 \rightarrow \bar{D}^0 K^+ \pi^-$
47.3 $\pm$ 1.5 $\pm$ 0.7		² AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
48.6 $\pm$ 1.3 $\pm$ 1.9	342k	AAIJ	13CC LHCb	$pp \rightarrow D^0 \pi^+ X$
49.7 $\pm$ 3.8 $\pm$ 6.4	2909	KUZMIN	07 BELL	$e^+ e^- \rightarrow \text{hadrons}$
34.1 $\pm$ 6.5 $\pm$ 4.2	3.5k	³ LINK	04A FOCS	γA
27 $\begin{smallmatrix} +11 \\ -8 \end{smallmatrix}$ $\pm$ 5	310	BERGFELD	94B CLE2	$e^+ e^- \rightarrow D^0 \pi^+ X$
23 $\pm$ 9 $\pm$ 5	185	FRABETTI	94B E687	$\gamma \text{Be} \rightarrow D^0 \pi^+ X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
46.0 $\pm$ 1.4 $\pm$ 1.8		⁴ AAIJ	15Y LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
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 Fit includes the contribution from $D_0^*(2400)^\pm$.				
⁴ Modeling the $\pi^+ \pi^-$ S -wave with the K-matrix formalism.				

NODE=M150W

OCCUR=2

NODE=M150W;LINKAGE=A

NODE=M150W;LINKAGE=B

NODE=M150W;LINKAGE=LI

NODE=M150W;LINKAGE=C

 $D_2^*(2460)^\pm$ DECAY MODES

NODE=M150215;NODE=M150

 $D_2^*(2460)^-$ modes are charge conjugates of modes below.

NODE=M150

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 \pi^+$	seen
Γ_2 $D^{*0} \pi^+$	seen
Γ_3 $D^+ \pi^+ \pi^-$	not seen
Γ_4 $D^{*+} \pi^+ \pi^-$	not seen

DESIG=1

DESIG=2;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$ DESIG=3;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$ DESIG=4;OUR EST; $\rightarrow$ UNCHECKED $\leftarrow$ **$D_2^*(2460)^\pm$ BRANCHING RATIOS**

NODE=M150220

$\Gamma(D^0\pi^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
seen	ALBRECHT	89F	ARG	$e^+e^- \rightarrow D^0\pi^+X$

NODE=M150R1

NODE=M150R1

$\Gamma(D^0\pi^+)/\Gamma(D^{*0}\pi^+)$				Γ_1/Γ_2
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.4 OUR AVERAGE				

NODE=M150R2

NODE=M150R2

1.2 $\pm$ 0.4 OUR AVERAGE

1.1 $\pm$ 0.4 $\begin{smallmatrix} +0.3 \\ -0.2 \end{smallmatrix}$	1371	¹ ABRAMOWICZ13	ZEUS	$e^\pm p \rightarrow D^{(*)0} \pi^+ X$
1.9 $\pm$ 1.1 $\pm$ 0.3		BERGFELD	94B CLE2	$e^+ e^- \rightarrow \text{hadrons}$

¹ 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.

NODE=M150R2;LINKAGE=AB

$\Gamma(D^0\pi^+)/[\Gamma(D^0\pi^+)+\Gamma(D^{*0}\pi^+)]$				$\Gamma_1/(\Gamma_1+\Gamma_2)$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M150R01

NODE=M150R01

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

0.62 $\pm$ 0.03 $\pm$ 0.02	3361	¹ AUBERT	09Y BABR	$\bar{B}^0 \rightarrow D_2^{*+} \ell^- \nu_\ell$

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.

NODE=M150R01;LINKAGE=AU

 $D_2^*(2460)^\pm$ REFERENCES

NODE=M150

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	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.)
KUZMIN	07	PR D76 012006	A. Kuzmin <i>et al.</i>	(BELLE Collab.)
LINK	04A	PL B586 11	J.M. Link <i>et al.</i>	(FOCUS 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.)
ALBRECHT	89B	PL B221 422	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	89F	PL B231 208	H. Albrecht <i>et al.</i>	(ARGUS Collab.)

REFID=56588

REFID=56609

REFID=55581

REFID=54743

REFID=53534

REFID=52929

REFID=51854

REFID=49775

REFID=44099

REFID=43687

REFID=40736

REFID=40931

$D_0(2550)^0$

$$I(J^P) = \frac{1}{2}(0^-)$$

OMITTED FROM SUMMARY TABLE

 $J^P = 0^-$ determined by AAIJ 20D.

NODE=M198

NODE=M198

NODE=M198M

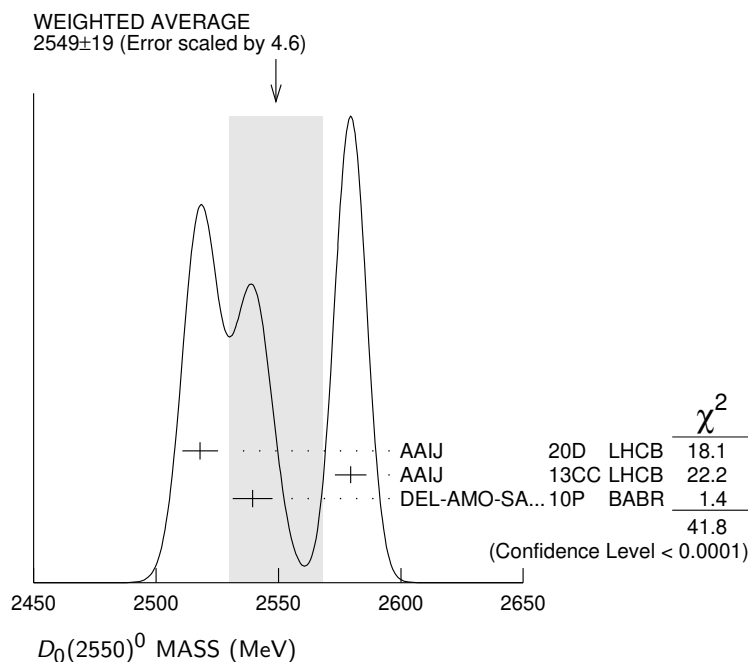
NODE=M198M

NEW

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. [2564 ± 20 MeV OUR 2020 AVERAGE Scale factor = 3.9]		
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**

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
165 ± 24 OUR AVERAGE		Error includes scale factor of 2.0. See the ideogram below. [135 ± 17 MeV OUR 2020 AVERAGE]		
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	$e^+ e^- \rightarrow D^{*+} \pi^- X$

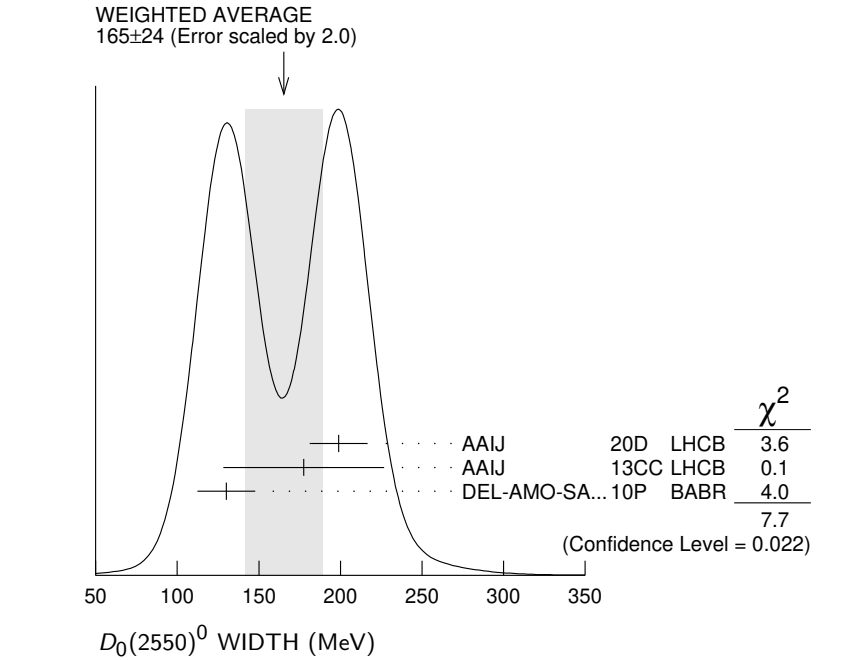
¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+} \pi^- \pi^-$ decay.

NODE=M198W

NODE=M198W

NEW

NODE=M198W;LINKAGE=A



$D_0(2550)^0$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^{*+}\pi^-$	seen

NODE=M198215;NODE=M198

DESIG=1;OUR EVAL;→ UNCHECKED ←

$D_0(2550)^0$ 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.

NODE=M198PAM

NODE=M198PAM

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.				

NODE=M198PAM

NODE=M198PAM;LINKAGE=A

$D_0(2550)^0$ 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=M198

REFID=60253
REFID=55581
REFID=53534

$D_1^*(2600)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

OMITTED FROM SUMMARY TABLE

was $D_J^*(2600)$ $J^P = 1^-$ determined by AAIJ 20D.

NODE=M199

NODE=M199

 $D_1^*(2600)^0$ MASS

NODE=M199M

NODE=M199M

NEW

VALUE (MeV) EVTS DOCUMENT ID TECN CHG COMMENT
2627 ±10 OUR AVERAGE Error includes scale factor of 4.4. See the ideogram below.
 [2623 ± 12 MeV OUR 2020 AVERAGE Scale factor = 4.8]

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	+	$e^+ e^- \rightarrow D^0 \pi^+ X$

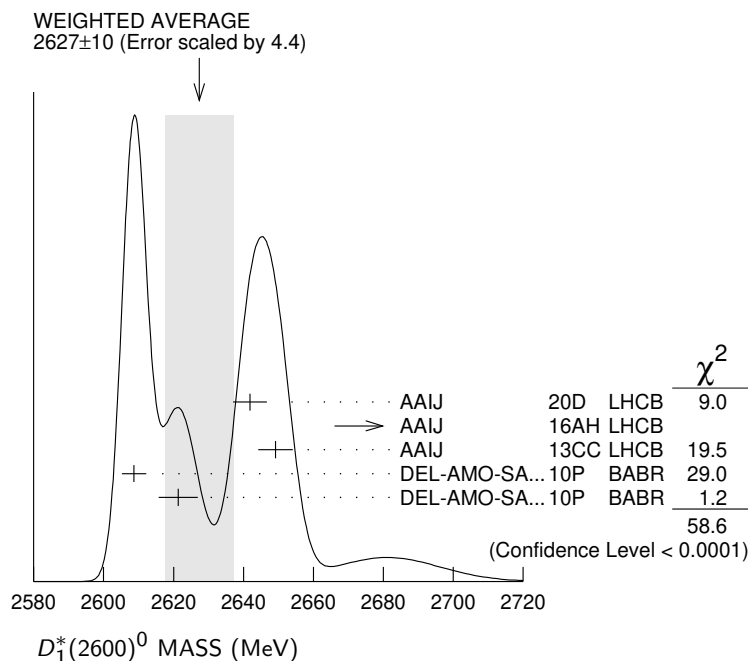
OCCUR=2

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=B

NODE=M199M;LINKAGE=A

NODE=M199M;LINKAGE=DE

 **$D_1^*(2600)^0$ WIDTH**

NODE=M199W

NODE=M199W

NEW

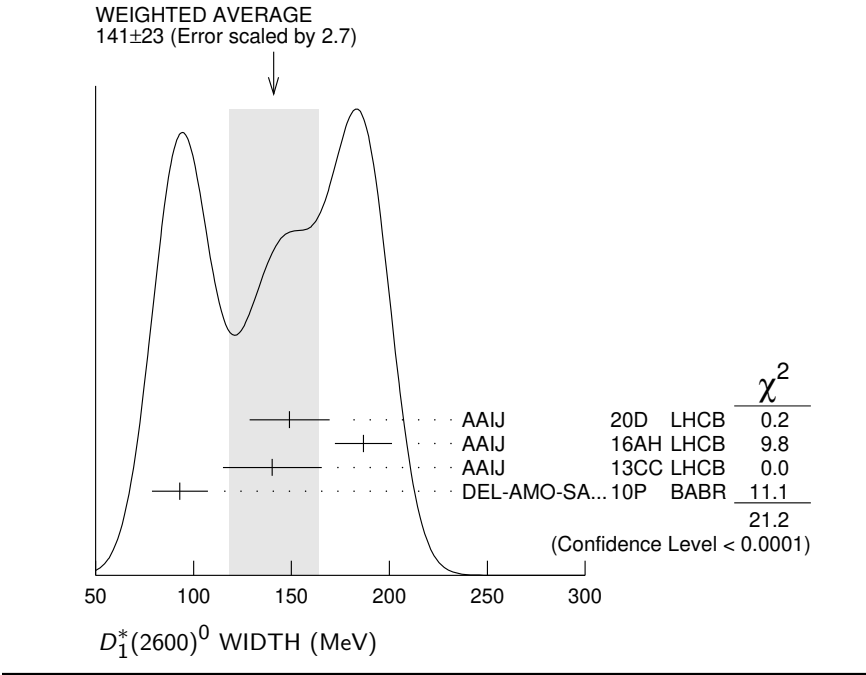
VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
141 ±23 OUR AVERAGE Error includes scale factor of 2.7. See the ideogram below.
 [139 ± 31 MeV OUR 2020 AVERAGE Scale factor = 3.2]

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.

$D^*(2640)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2637±2±6	66 ± 14	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

$D^*(2640)^\pm$ WIDTH

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<15	95	ABREU	98M DLPH	$e^+e^- \rightarrow D^{*+}\pi^+\pi^-X$

$D^*(2640)^+$ DECAY MODES

$D^*(2640)^-$ modes are charge conjugates of modes below.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D^*(2010)^+\pi^+\pi^-$	seen

$D^*(2640)^\pm$ REFERENCES

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.)

$D_2(2740)^0$

$$I(J^P) = \frac{1}{2}(2^-)$$

OMITTED FROM SUMMARY TABLE
was $D(2740)^0$
 $J^P = 2^-$ determined by (AAIJ 20D).

$D_2(2740)^0$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
2747 ±6 OUR AVERAGE				
[2737 ± 12 MeV OUR 2020 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	$pp \rightarrow D^{*+}\pi^-X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+}\pi^-\pi^-$ decay.

$D_2(2740)^0$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
88 ±19 OUR AVERAGE				
[73 ± 28 MeV OUR 2020 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	$pp \rightarrow D^{*+}\pi^-X$

¹ From a full four-body amplitude analysis of the $B^- \rightarrow D^{*+}\pi^-\pi^-$ decay.

NODE=M158

NODE=M158

NODE=M158M

NODE=M158M

NODE=M158W

NODE=M158W

NODE=M158215;NODE=M158

NODE=M158

DESIG=1;OUR EST;→ UNCHECKED ←

NODE=M158

REFID=52733
REFID=48296
REFID=46315

NODE=M228

NODE=M228

NODE=M228M

NODE=M228M
NEW

NODE=M228M;LINKAGE=A

NODE=M228W

NODE=M228W
NEW

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.						
[2763.5 ± 3.4 MeV OUR 2020 AVERAGE Scale factor = 2.2]							
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 ±11 ±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
NEW

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=2

NODE=M203M;LINKAGE=D

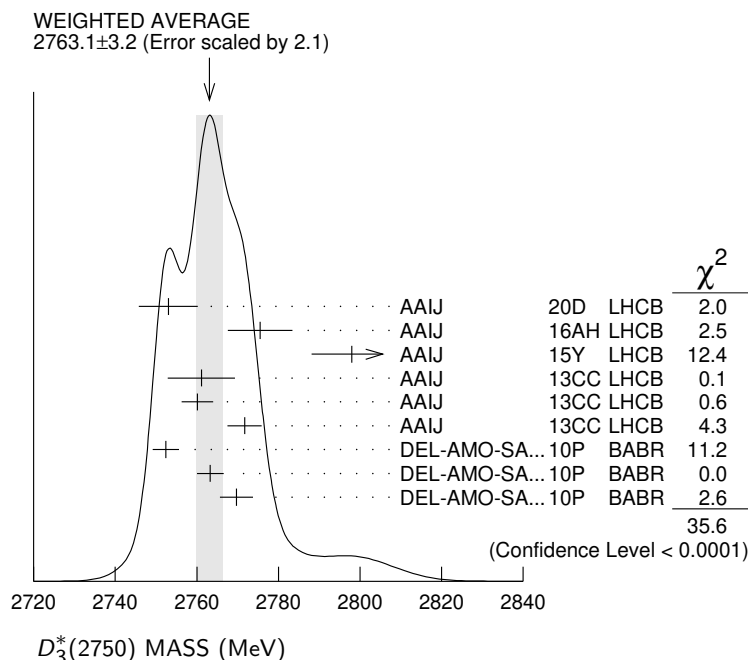
NODE=M203M;LINKAGE=C

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 ± 5 OUR AVERAGE					
66 ±10 ±14	79k	¹ AAIJ	20D	LHCb	$B^- \rightarrow D^{*+} \pi^- \pi^-$
95.3 ± 9.6 ± 34.0	28k	² AAIJ	16AH	LHCb	$B^- \rightarrow D^+ \pi^- \pi^-$
105 ±18 ±24		³ AAIJ	15Y	LHCb	$B^0 \rightarrow \bar{D}^0 \pi^+ \pi^-$
74.4 ± 3.4 ± 37.0	14k	AAIJ	13CC	LHCb 0	$pp \rightarrow D^{*+} \pi^- X$
74.4 ± 3.4 ± 19.1	56k	AAIJ	13CC	LHCb 0	$pp \rightarrow D^+ \pi^- X$
66.7 ± 6.6 ± 10.5	20k	AAIJ	13CC	LHCb +	$pp \rightarrow D^0 \pi^+ X$
71 ± 6 ± 11	23.5k	⁴ DEL-AMO-SA...10P	BABR		$e^+ e^- \rightarrow D^{*+} \pi^- X$
60.9 ± 5.1 ± 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 ±27 ±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

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

$\Gamma(D^+ \pi^-)/\Gamma(D^{*+} \pi^-)$	VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_2/Γ_5
0.42 ± 0.05 ± 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

$177 \pm 32 \pm 21$	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)
$\Gamma_1 \quad D^+ K^-$	seen

$D_1^*(2760)^0$ BRANCHING RATIOS

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

VALUE	DOCUMENT ID	TECN	COMMENT

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

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
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

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.

OCCUR=2

NODE=M229M;LINKAGE=D

NODE=M229M;LINKAGE=A

NODE=M229M;LINKAGE=B

NODE=M229M;LINKAGE=C

 $D(3000)^0$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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

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.

OCCUR=2

NODE=M229W;LINKAGE=D

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	$pp \rightarrow D^{*+} \pi^- X$

⁹ Systematic uncertainty not estimated.

NODE=M229PAM

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 ($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \text{ similarly for } D_s^{*\pm}$$

$$D_s^{*\pm}$$

$$I(J^P) = 0(?)$$

J^P is natural, width and decay modes consistent with 1^- .

$D_s^{*\pm}$ MASS

The fit includes $D_s^\pm, D_s^0, D_s^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2112.2$\pm$0.4 OUR FIT			
2106.6$\pm$2.1$\pm$2.7	¹ BLAYLOCK	87	MRK3 $e^+e^- \rightarrow D_s^\pm \gamma X$
¹ Assuming $D_s^\pm$ mass = 1968.7 $\pm$ 0.9 MeV.			

$$m_{D_s^{*\pm}} - m_{D_s^\pm}$$

The fit includes $D_s^\pm, D_s^0, D_s^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
143.8 $\pm$ 0.4 OUR FIT				
143.9 $\pm$ 0.4 OUR AVERAGE				
143.76 $\pm$ 0.39 $\pm$ 0.40		GRONBERG	95	CLE2 e^+e^-
144.22 $\pm$ 0.47 $\pm$ 0.37		BROWN	94	CLE2 e^+e^-
142.5 $\pm$ 0.8 $\pm$ 1.5		² ALBRECHT	88	ARG $e^+e^- \rightarrow D_s^\pm \gamma X$
139.5 $\pm$ 8.3 $\pm$ 9.7	60	AIHARA	84D	TPC $e^+e^- \rightarrow$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
143.0 $\pm$ 18.0	8	ASRATYAN	85	HLBC FNAL 15-ft, ν - ² H
110 $\pm$ 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 $E_{\text{cm}}^{\text{ee}} = 10.2$ 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)
$\Gamma_1 \quad D_s^+ \gamma$	(93.5 $\pm$ 0.7) %
$\Gamma_2 \quad D_s^+ \pi^0$	(5.8 $\pm$ 0.7) %
$\Gamma_3 \quad D_s^+ e^+ e^-$	(6.7 $\pm$ 1.6) $\times 10^{-3}$

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

CONSTRAINED FIT INFORMATION

An overall fit to 2 branching ratios uses 3 measurements and one constraint to determine 3 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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	−97	
x_3	−19	−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

0.935 ± 0.007 OUR FIT

• • • 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	DOCUMENT ID	TECN	COMMENT

NODE=S074R2
NODE=S074R2

0.062 ± 0.008 OUR FIT**0.062 ± 0.008 OUR AVERAGE**

0.062 ± 0.005 ± 0.006	AUBERT,BE	05G	BABR	10.6 $e^+ e^- \rightarrow \text{hadrons}$
0.062 $^{+0.020}_{-0.018}$ ± 0.022	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 $e^+ e^- \rightarrow \text{hadrons}$

$D_s^{*\pm}$ REFERENCES

NODE=S074

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 $D_{s0}^*(2317)^+$.

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

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^-

NODE=M172M

OCCUR=2

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.

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

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^-

NODE=M172DM

OCCUR=2

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.

NODE=M172DM;LINKAGE=K3

NODE=M172DM;LINKAGE=A1

NODE=M172DM;LINKAGE=C1

NODE=M172DM;LINKAGE=A2

NODE=M172DM;LINKAGE=C2

$$D_{s0}^*(2317)^\pm \text{ WIDTH}$$

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^-

NODE=M172W

NODE=M172W

$D_{s0}^*(2317)^\pm$ 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

 $D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

NODE=M173

 $D_{s1}(2460)^\pm$ MASS

NODE=M173M

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 ⁻ → $D_s^+ \gamma X$
2458.6±1.0±2.5	560	AUBERT	06P BABR	10.6 e ⁺ e ⁻ → $D_s^+ \pi^0 \gamma X$
2460.2±0.2±0.8	123	AUBERT	06P BABR	10.6 e ⁺ e ⁻ → $D_s^+ \pi^+ \pi^- X$
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	$B \rightarrow D_{s1}(2460)^+ \bar{D}^{(*)}$
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 ⁻
2459.9±0.9±1.6	60	^{6,7} MIKAMI	04 BELL	10.6 e ⁺ e ⁻
2459.2±1.6±2.0	57	KROKOVNY	03B BELL	10.6 e ⁺ e ⁻

NODE=M173M

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=2

OCCUR=2

OCCUR=3

¹ The average of the values obtained from the $D_s^+ \gamma$, $D_s^+ \pi^0 \gamma$, $D_s^+ \pi^+ \pi^-$ final state.

NODE=M173M;LINKAGE=UB

² Systematic errors not evaluated. From the decay to $D_s^{*+} \pi^0$.

NODE=M173M;LINKAGE=AU

³ Systematic errors not evaluated. From the decay to $D_s^+ \gamma$.

NODE=M173M;LINKAGE=AB

⁴ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}}$.

NODE=M173M;LINKAGE=B1

⁵ Using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173M;LINKAGE=B2

⁶ Not independent of the corresponding $m_{D_{s1}(2460)^\pm} - m_{D_s^\pm}$.

NODE=M173M;LINKAGE=B3

⁷ Using $m_{D_s^+} = 1968.5 \pm 0.6$ MeV.

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.

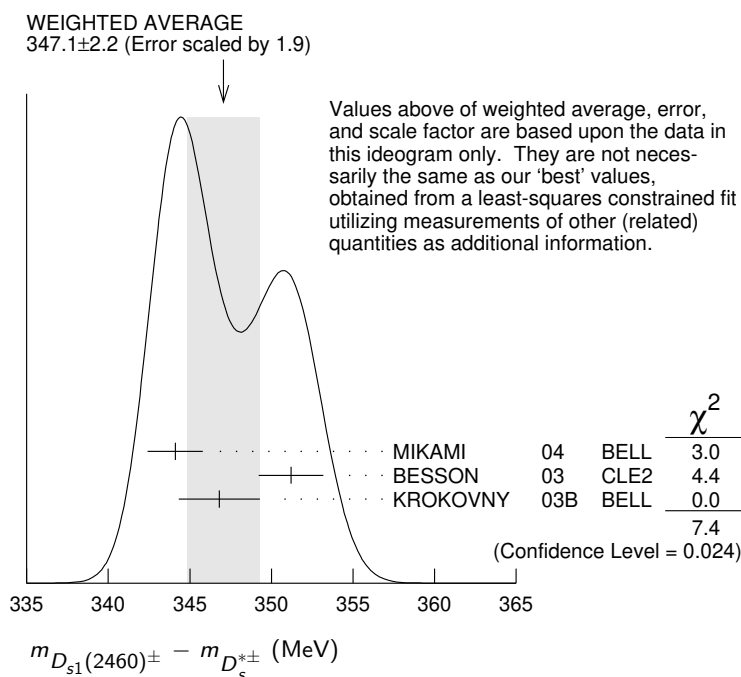
NODE=M173MD

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 ⁻

NODE=M173MD

⁸ Recalculated by us using $m_{D_s^{*+}} = 2112.4 \pm 0.7$ MeV.

NODE=M173MD;LINKAGE=K3



$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}}$

The fit includes $D^{\pm}$, D^0 , $D_s^{\pm}$, $D_s^{*\pm}$, D_s^{*0} , $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ mass and mass difference measurements.

NODE=M173DM

NODE=M173DM

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
491.2±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 1.2.				
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

NODE=M121W

NODE=M121W

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	$D_{s1}^* \rightarrow D^*(2010) K^0$

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

NODE=M121215;NODE=M121

NODE=M121

$D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

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 $D^+ \pi^- K^+$	0.028±0.005	DESIG=8
Γ_5 $D^*(2007)^0 K^+$	DEFINED AS 1	DESIG=4
Γ_6 $D^+ K^0$	<0.34	90% DESIG=2
Γ_7 $D^0 K^+$	<0.12	90% DESIG=5
Γ_8 $D_S^{*+} \gamma$	possibly seen	DESIG=3
Γ_9 $D_S^+ \pi^+ \pi^-$	seen	DESIG=6

$D_{s1}(2536)^+$ BRANCHING RATIOS

NODE=M121220

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$					Γ_5/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	$e^\pm p \rightarrow D^{*+} K_S^0 X,$
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

$\Gamma((D^*(2010)^+ K^0)_{S-wave})/\Gamma(D^*(2010)^+ K^0)$					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_4/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_6/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_7/Γ_5
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_8/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_8/Γ_5
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_9/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

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

$D_{s2}^*(2573)$

$$I(J^P) = 0(2^+)$$

J^P is natural, width and decay modes consistent with 2^+ .
AAIJ 14AW confirms $J^P = 2^+$.

NODE=M148

NODE=M148

NODE=M148M

NODE=M148M

 $D_{s2}^*(2573)$ MASS

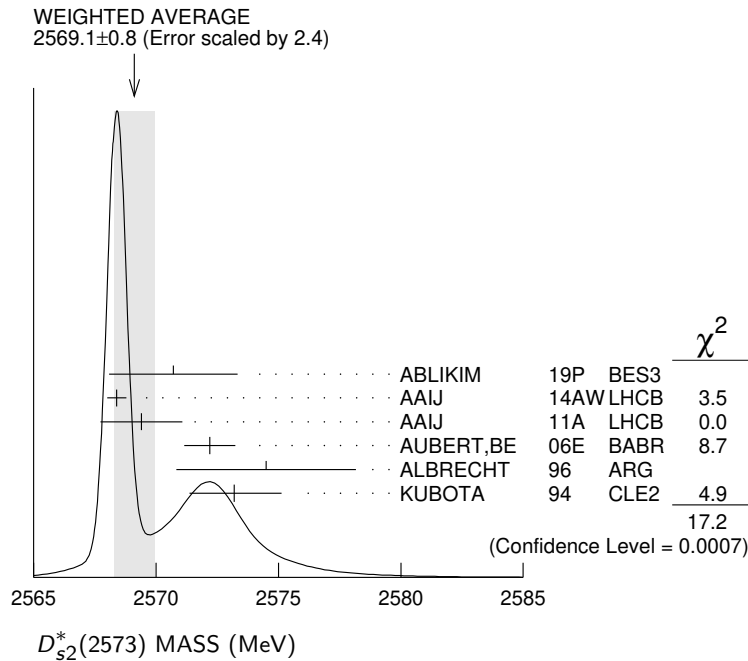
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2569.1 ± 0.8 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
2570.7 $\pm 2.0 \pm 1.7$	62	¹ ABLIKIM	19P BES3	$4.6 e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$
2568.39 $\pm 0.29 \pm 0.26$		AAIJ	14AW LHCb	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
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	$e^+ e^- \sim 10.5 \text{ GeV}$
• • • 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 $m_{D^0} = 1864.5 \pm 0.5 \text{ MeV}$ 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±0.5±0.6		AAIJ	14AW	LHCB	$B_s^0 \rightarrow \bar{D}^0 K^- \pi^+$
12.1±4.5±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	$e^+ e^- \rightarrow D K X$
10.4±8.3±3.0		ALBRECHT	96	ARG	$e^+ e^- \rightarrow D^0 K^+ X$
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 $\Sigma^- A \rightarrow D^0 K^+ X$

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.

Mode	Fraction (Γ_i/Γ)
Γ_1 $D^0 K^+$	seen
Γ_2 $D^*(2007)^0 K^+$	not seen
Γ_3 $D^+ K_S^0$	
Γ_4 $D^{*+} K_S^0$	

NODE=M148215;NODE=M148

NODE=M148

DESIG=1

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=4

DESIG=5

$D_{s2}^*(2573)^+$ BRANCHING RATIOS

$\Gamma(D^0 K^+)/\Gamma_{\text{total}}$	Γ_1/Γ
<u>VALUE</u>	<u>EVTS</u>
<u>DOCUMENT ID</u>	<u>TECN</u>
<u>CHG</u>	<u>COMMENT</u>
seen	217 KUBOTA 94 CLE2 ± $e^+ e^- \sim 10.5 \text{ GeV}$

NODE=M148220

NODE=M148R2
NODE=M148R2

$\Gamma(D^*(2007)^0 K^+)/\Gamma(D^0 K^+)$	Γ_2/Γ_1
<u>VALUE</u>	<u>CL%</u>
<u>DOCUMENT ID</u>	<u>TECN</u>
<u>CHG</u>	<u>COMMENT</u>
<0.33	90 KUBOTA 94 CLE2 + $e^+ e^- \sim 10.5 \text{ GeV}$

NODE=M148R1
NODE=M148R1

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$	Γ_4/Γ_3
<u>VALUE</u>	<u>EVTS</u>
<u>DOCUMENT ID</u>	<u>TECN</u>
<u>COMMENT</u>	
0.044±0.005±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

ABLIKIM	19P	CP C43 031001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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	11A	PL B698 14	R. Aaij <i>et al.</i>	(LHCb Collab.)
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)
EVDOKIMOV	04	PRL 93 242001	A.V. Evdokimov <i>et al.</i>	(SELEX Collab.)
HEISTER	02B	PL B526 34	A. Heister <i>et al.</i>	(ALEPH Collab.)
ALBRECHT	96	ZPHY C69 405	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KUBOTA	94	PRL 72 1972	Y. Kubota <i>et al.</i>	(CLEO Collab.)

NODE=M148

REFID=59617
REFID=60464
REFID=56105
REFID=16665
REFID=51512
REFID=50337
REFID=48562
REFID=44631
REFID=43781

NODE=M182

 $D_{s1}^*(2700)^\pm$

$$I(J^P) = 0(1^-)$$

 $D_{s1}^*(2700)^+$ MASS

NODE=M182M

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
2714 ± 5 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.
 [2708.3^{+4.0}_{-3.4} MeV OUR 2020 AVERAGE]

NODE=M182M

NEW

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 $e^+ e^- \rightarrow DKX$

OCCUR=2

OCCUR=3

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.

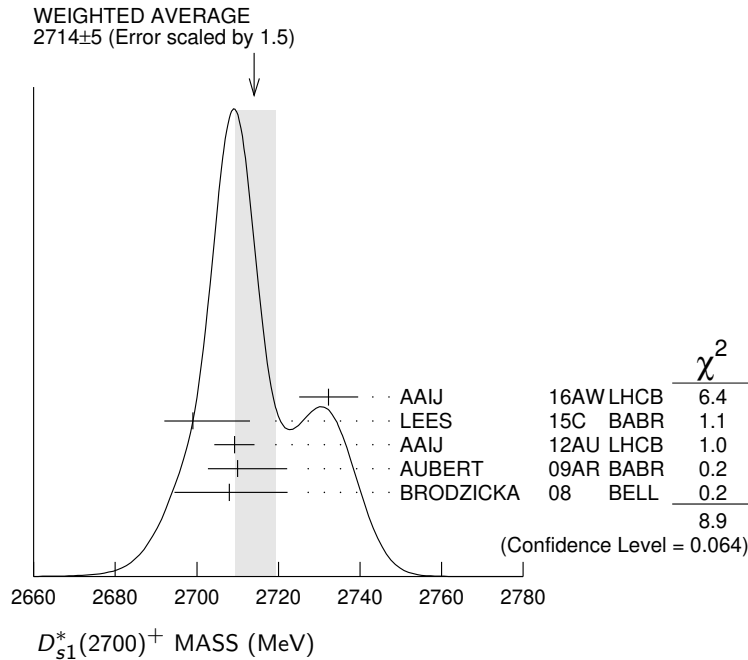
⁴ Superseded by AUBERT 09AR.

NODE=M182M;LINKAGE=B

NODE=M182M;LINKAGE=AA

NODE=M182M;LINKAGE=AB

NODE=M182M;LINKAGE=AU

 $D_{s1}^*(2700)^+$ WIDTH

NODE=M182W

VALUE (MeV) EVTS DOCUMENT ID TECN COMMENT
122 ± 10 OUR AVERAGE
 [120 ± 11 MeV OUR 2020 AVERAGE]

NODE=M182W

NEW

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	$B^+ \rightarrow D^0 \bar{D}^0 K^+$

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

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	$10.6 e^+ e^- \rightarrow DKX$
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.						

OCCUR=2

OCCUR=3

NODE=M182W;LINKAGE=A

NODE=M182W;LINKAGE=AA

NODE=M182W;LINKAGE=AB

NODE=M182W;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ DECAY MODES

NODE=M182215;NODE=M182

Mode	
Γ_1	DK
Γ_2	$D^0 K^+$
Γ_3	$D^+ K_S^0$
Γ_4	$D^* K$
Γ_5	$D^{*0} K^+$
Γ_6	$D^{*+} K_S^0$

DESIG=2

DESIG=1

DESIG=3

DESIG=4

DESIG=5

DESIG=6

$D_{s1}^*(2700)^\pm$ BRANCHING RATIOS

NODE=M182225

$\Gamma(D^* K)/\Gamma(DK)$				Γ_4/Γ_1	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.91 \pm 0.13 \pm 0.12$	10.4k	¹ AUBERT	09AR BABR	$e^+ e^- \rightarrow D^{(*)} K X$	

NODE=M182R01
NODE=M182R01

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M182R01;LINKAGE=AU

$\Gamma(D^{*0} K^+)/\Gamma(D^0 K^+)$				Γ_5/Γ_2	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M182R02
NODE=M182R02

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

$0.88 \pm 0.14 \pm 0.14$ 7716 ¹ AUBERT 09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

¹ From the $D^{*0} K^+$ and $D^0 K^+$, where $D^{*0} \rightarrow D^0 \pi^0$.

NODE=M182R02;LINKAGE=AU

$\Gamma(D^{*+} K_S^0)/\Gamma(D^+ K_S^0)$				Γ_6/Γ_3	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	

NODE=M182R03
NODE=M182R03

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

$1.14 \pm 0.39 \pm 0.23$ 2700 ¹ AUBERT 09AR BABR $e^+ e^- \rightarrow D^{(*)} K X$

¹ From the $D^{*+} K_S^0$ and $D^+ K_S^0$, where $D^{*+} \rightarrow D^+ \pi^0$.

NODE=M182R03;LINKAGE=AU

$D_{s1}^*(2700)^\pm$ REFERENCES

NODE=M182

AAIJ	16AW	JHEP 1602 133	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=60464
LEES	15C	PR D91 052002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56412
AAIJ	12AU	JHEP 1210 151	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=54735
AUBERT	09AR	PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=53135
BRODZICKA	08	PRL 100 092001	J. Brodzicka <i>et al.</i>	(BELLE Collab.)	REFID=52144
AUBERT,BE	06E	PRL 97 222001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51512

$D_{s1}^*(2860)^\pm$

$$I(J^P) = 0(1^-)$$

OMITTED FROM SUMMARY TABLE

J^P consistent with 1^- 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=M196

NODE=M196

 $D_{s1}^*(2860)^+$ MASS

NODE=M196M

NODE=M196M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2859 ±12 ±24		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. • • •				
2866.1 ± 1.0 ± 6.3	36k	^{2,3} AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
2862 ± 2 ± $\frac{5}{2}$	3122	^{3,4} 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-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;LINKAGE=A

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 $D_{sJ}^*(2860)^+$.

NODE=M196M;LINKAGE=AA

³ Possible contribution from the $D_{s3}^*(2860)$ state.

NODE=M196M;LINKAGE=B
NODE=M196M;LINKAGE=AB

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M196M;LINKAGE=AU

 $D_{s1}^*(2860)^+$ WIDTH

NODE=M196W

NODE=M196W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
159 ±23 ±77		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. • • •				
69.9 ± 3.2 ± 6.6	36k	^{2,3} AAIJ	12AU LHCb	$pp \rightarrow (DK)^+ X$ at 7 TeV
48 ± 3 ± 6	3122	^{3,4} 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-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;LINKAGE=A

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 $D_{sJ}^*(2860)^+$.

NODE=M196W;LINKAGE=AA

³ Possible contribution from the $D_{s3}^*(2860)$ state.

NODE=M196W;LINKAGE=B
NODE=M196W;LINKAGE=AB

⁴ From simultaneous fits to the two DK mass spectra and to the total D^*K mass spectrum.

⁵ Superseded by AUBERT 09AR.

NODE=M196W;LINKAGE=AU

 $D_{s1}^*(2860)^\pm$ DECAY MODES

NODE=M196215;NODE=M196

Mode	
Γ_1	DK
Γ_2	$D^0 K^+$
Γ_3	$D^+ K_S^0$
Γ_4	$D^* K$
Γ_5	$D^{*0} K^+$
Γ_6	$D^{*+} K_S^0$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=6

 $D_{s1}^*(2860)^\pm$ BRANCHING RATIOS

NODE=M196225

 $\Gamma(D^*K)/\Gamma(DK)$ Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.10 ± 0.15 ± 0.19	3122	¹ AUBERT	09AR BABR	$e^+e^- \rightarrow D^{(*)} K X$

NODE=M196R01
NODE=M196R01

¹ From the average of the corresponding ratios with $D^{(*)0} K^+$ and $D^{(*)+} K_S^0$.

NODE=M196R01;LINKAGE=AU

$\Gamma(D^{*0}K^+)/\Gamma(D^0K^+)$ Γ_5/Γ_2

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

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 $D^{*0} \rightarrow D^0\pi^0$.NODE=M196R02
NODE=M196R02

NODE=M196R02;LINKAGE=AU

 $\Gamma(D^{*+}K_S^0)/\Gamma(D^+K_S^0)$ Γ_6/Γ_3

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

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

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=M196R03
NODE=M196R03

NODE=M196R03;LINKAGE=AU

 $D_{s1}^*(2860)^\pm$ REFERENCES

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=M196

REFID=56105
REFID=54735
REFID=53135
REFID=51512

NODE=M226

 $D_{s3}^*(2860)^\pm$ $I(J^P) = 0(3^-)$

OMITTED FROM SUMMARY TABLE

 J^P consistent with 3^- from angular analysis of AAIJ 14AW.

NODE=M226

 $D_{s3}^*(2860)^+$ MASS

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 TeV¹ 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 10 σ .

NODE=M226M

NODE=M226M

NODE=M226M;LINKAGE=A

 $D_{s3}^*(2860)^+$ WIDTH

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 TeV¹ 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 10 σ .

NODE=M226W

NODE=M226W

NODE=M226W;LINKAGE=A

 $D_{s3}^*(2860)^\pm$ 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

NODE=M226

REFID=60464
REFID=56105

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

NODE=M197M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$3044 \pm 8^{+30}_{-5}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

NODE=M197M

$D_{sJ}(3040)^+$ WIDTH

NODE=M197W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$239 \pm 35^{+46}_{-42}$	AUBERT	09AR BABR	$e^+ e^- \rightarrow D^* K X$

NODE=M197W

$D_{sJ}(3040)^{\pm}$ DECAY MODES

NODE=M197215;NODE=M197

Mode	
Γ_1	$D^* K$
Γ_2	$D^{*0} K^+$
Γ_3	$D^{*+} K^0_S$

DESIG=1
DESIG=2
DESIG=3

$D_{sJ}(3040)^{\pm}$ REFERENCES

NODE=M197

AUBERT	09AR PR D80 092003	B. Aubert <i>et al.</i>	(BABAR Collab.)

REFID=53135

BOTTOM MESONS

$(B = \pm 1)$

NODE=MXXX045

$$B^+ = u\bar{b}, B^0 = d\bar{b}, \bar{B}^0 = \bar{d}b, B^- = \bar{u}b, \text{ similarly for } B^{*'}\text{'s}$$

NODE=MXXX045

$B_1(5721)$

$$I(J^P) = \frac{1}{2}(1^+)$$

I, J, P need confirmation.

NODE=M244

Quantum numbers shown are quark-model predictions.

NODE=M244

$B_1(5721)$ MASS

NODE=M244205

$B_1(5721)^+$ mass

NODE=M244M+

OUR FIT uses $m_{B^{*0}}$ and $m_{B_1^+} - m_{B^{*0}}$ to determine $m_{B_1(5721)^+}$.

NODE=M244M+
NODE=M244M+

VALUE (MeV)	DOCUMENT ID
$5725.9^{+2.5}_{-2.7}$ OUR FIT	

$$m_{B_1^+} - m_{B^{*0}}$$

NODE=M244DM+
NODE=M244DM+

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$401.2^{+2.4}_{-2.7}$ OUR FIT				

$$401.2^{+2.4}_{-2.7} \text{ OUR AVERAGE}$$

$400.5 \pm 1.8 \pm 3.1$	8k	1 AAIJ	15AB LHCb	pp at 7, 8 TeV
$402 \pm 3^{+1}_{-3}$		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 14I reports $m_{B_1(5721)^+} - m_{B^{*0}} - m_{\pi^+} = 262 \pm 3_{-3}^{+1}$ MeV which we adjusted by the π^+ mass.

NODE=M244DM+;LINKAGE=A

NODE=M244DM+;LINKAGE=AA

$B_1(5721)^0$ mass

OUR FIT uses mass differences measurements listed below to determine the mass $m_{B_1(5721)^0}$.

VALUE (MeV)	DOCUMENT ID
5726.1±1.3 OUR FIT	Error includes scale factor of 1.2.

NODE=M244M0
NODE=M244M0

NODE=M244M0

$m_{B_1^0} - m_{B^+}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
446.7±1.3 OUR FIT	Error includes scale factor of 1.2.		

441.5±2.4±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 14I

¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$.

NODE=M244DM0
NODE=M244DM0

NODE=M244DM0;LINKAGE=AA

$m_{B_1^0} - m_{B^{*+}}$

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

$402.3 \pm 0.9^{+1.1}_{-1.2}$ ² AALTONEN 14I CDF $p\bar{p}$ at 1.96 TeV

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
NODE=M244DM1

NODE=M244DM1;LINKAGE=B

NODE=M244DM1;LINKAGE=AA

$B_1(5721)$ WIDTH

NODE=M244210

$B_1(5721)^+$ width

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
31 ± 6 OUR AVERAGE	Error includes scale factor of 1.1.			

$29.1 \pm 3.6 \pm 4.3$ 8k AAIJ 15AB LHCB pp at 7, 8 TeV

49^{+12+2}_{-10-13} AALTONEN 14I CDF $p\bar{p}$ at 1.96 TeV

NODE=M244W+
NODE=M244W+

$B_1(5721)^0$ width

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
27.5±3.4 OUR AVERAGE	Error includes scale factor of 1.1.			

$30.1 \pm 1.5 \pm 3.5$ 35k AAIJ 15AB LHCB pp at 7, 8 TeV

$23 \pm 3 \pm 4$ AALTONEN 14I CDF $p\bar{p}$ at 1.96 TeV

NODE=M244W0
NODE=M244W0

$B_1(5721)$ DECAY MODES

NODE=M244215;NODE=M244

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*+} \pi^-$	seen

DESIG=1

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

Γ_1/Γ

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

¹ Observed in $B_1^0 \rightarrow B^{*+} \pi^-$ with $B^{*+} \rightarrow B^+ \gamma$ and $B^+ \rightarrow J/\psi \pi^+$.

NODE=M244R01
NODE=M244R01

OCCUR=2

NODE=M244R01;LINKAGE=AB

$B_1(5721)$ 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.)
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.)

NODE=M244

REFID=56628
REFID=56029
REFID=52700
REFID=52014

NODE=M151

 $B_J^*(5732)$

$I(J^P) = ?(??)$
 I, J, P need confirmation.

OMITTED FROM SUMMARY TABLE

also known as B^{**}

Quantum numbers shown are quark-model predictions. Signal can be interpreted as stemming from several narrow and broad resonances.

NODE=M151

 $B_J^*(5732)$ MASS

NODE=M151M

NODE=M151M

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	$e^+e^- \rightarrow Z$
$5704 \pm 4 \pm 10$	1944	³ BUSKULIC	96D ALEP	$E_{cm}^{ee} = 88-94$ GeV
$5732 \pm 5 \pm 20$	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88-94$ GeV
5681 ± 11	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ 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

NODE=M151W

NODE=M151W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
128 ± 18 OUR AVERAGE				
145 ± 28	2157	ABREU	95B DLPH	$E_{cm}^{ee} = 88-94$ GeV
116 ± 24	1738	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

 $B_J^*(5732)$ DECAY MODES

NODE=M151215;NODE=M151

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^*\pi + B\pi$	seen
Γ_2 $B^*\pi(X)$	[a] $(85 \pm 29)\%$

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=2

[a] X refers to decay modes with or without additional accompanying decay particles.

LINKAGE=151

$B_s^*(5732)$ 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

 $B_s^*(5732)$ REFERENCES

NODE=M151

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.)

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

 $B_2^*(5747)^+$ mass

NODE=M245M+

OUR FIT uses m_{B^0} and $m_{B_2^{*+}} - m_{B^0}$ to determine $m_{B_2^*(5747)^+}$.

VALUE (MeV)

DOCUMENT ID

5737.2 $\pm$ 0.7 OUR FIT

NODE=M245M+

NODE=M245M+

 $m_{B_2^{*+}} - m_{B^0}$

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 AAIJ

15AB LHCb

 pp at 7, 8 TeV457.3 $\pm$ 1.3 $^{+0.3}_{-0.9}$ ² AALTONEN

14i CDF

 $p\bar{p}$ at 1.96 TeV

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 14i reports $m_{B_2^*(5747)^+} - m_{B^0} - m_{\pi^+} = 317.7 \pm 1.2^{+0.3}_{-0.9}$ MeV which we adjusted by the π^+ mass.

NODE=M245DM+;LINKAGE=B

NODE=M245DM+;LINKAGE=A

 $B_2^*(5747)^0$ mass

NODE=M245M0

NODE=M245M0

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

5739.5 $\pm$ 0.7 OUR FIT Error includes scale factor of 1.4.

NODE=M245M0

 $m_{B_2^0} - m_{B_1^0}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.4 $\pm$ 1.4 OUR FIT Error includes scale factor of 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 $^{+2.2+1.2}_{-2.5-1.4}$ ¹ AALTONEN

09D CDF

Repl. by AALTONEN 14i

¹ Observed in $B_2^{*0} \rightarrow B^{*+} \pi^-$ and $B_2^{*0} \rightarrow B^+ \pi^-$.

NODE=M245DM0
NODE=M245DM0

NODE=M245DM0;LINKAGE=AB

$m_{B_2^{*0}} - m_{B^+}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
460.2 ± 0.6 OUR FIT	Error includes scale factor of 1.4.			
459.9 ± 0.8 OUR AVERAGE	Error includes scale factor of 1.8.			
460.18 ± 0.37 ± 0.33	17k	¹ AAIJ	15AB LHCB	pp at 7, 8 TeV
457.5 ± 1.2 $^{+0.8}_{-0.9}$		² AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

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 $m_{B_2^{*0}(5747)} - m_{B^+} - m_{\pi^-} = 317.9 \pm 1.2^{+0.8}_{-0.9}$ MeV which we adjusted by the π^- mass.

NODE=M245DM2
NODE=M245DM2

NODE=M245DM2;LINKAGE=A

NODE=M245DM2;LINKAGE=AA

 $B_2^{*}(5747)$ WIDTH $B_2^{*}(5747)^+$ 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 $^{+4}_{-3}$ $^{+3}_{-4}$		AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV

NODE=M245210

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 $^{+3}_{-2}$ $^{+4}_{-5}$		AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
22.7 $^{+3.8}_{-3.2}$ $^{+3.2}_{-10.2}$		AALTONEN	09D CDF	Repl. by AALTONEN 14l

NODE=M245W0
NODE=M245W0

 $B_2^{*}(5747)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	seen
Γ_2 $B^*\pi$	seen

NODE=M245215;NODE=M245

DESIG=1

DESIG=2

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

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

 Γ_1/Γ

NODE=M245R01
NODE=M245R01

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

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

 Γ_2/Γ

NODE=M245R02
NODE=M245R02

 $\Gamma(B^*\pi)/\Gamma(B\pi)$

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

 Γ_2/Γ_1

NODE=M245R03
NODE=M245R03

¹ Converted from measured ratio of $R = B(B_2^{*0} \rightarrow B^{*+}\pi^-) / B(B_2^{*0} \rightarrow B^{(*)+}\pi^-) = 0.475 \pm 0.095 \pm 0.069$.

OCCUR=2

NODE=M245R03;LINKAGE=AB

 $B_2^{*}(5747)$ REFERENCES

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.)

NODE=M245

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

$224 \pm 24 \pm 80$	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+

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

$127 \pm 17 \pm 34$	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

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 *et al.* (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+NODE=M248DM+
NODE=M248DM+ **$B_J(5970)$ 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

5964 ± 5 OUR FIT **$m_{B_J(5970)^+} - m_{B^0}$**

VALUE (MeV)

EPTS

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 by the 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.

OCCUR=2

NODE=M248DM+;LINKAGE=B

NODE=M248DM+;LINKAGE=A

NODE=M248DM+;LINKAGE=C

 $m_{B_J(5970)^+} - m_{B^{*0}}$

VALUE (MeV)

EPTS

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.NODE=M248DM1
NODE=M248DM1

NODE=M248DM1;LINKAGE=A

 $B_J(5970)^0$ MASSOUR 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)

EPTS

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 by the 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.

NODE=M248M0

NODE=M248M0
NODE=M248M0NODE=M248DM0
NODE=M248DM0

OCCUR=2

NODE=M248DM0;LINKAGE=B

NODE=M248DM0;LINKAGE=A

NODE=M248DM0;LINKAGE=C

$m_{B_J(5970)^0} - m_{B^{*+}}$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
691.6 ± 3.7 ± 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

NODE=M248210

 $B_J(5970)^+$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
62 ± 20 OUR AVERAGE				

63 ± 15 ± 17 2k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

60⁺³⁰₋₂₀ ± 40 1.4k AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeV

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

61 ± 14 ± 17 2k ² AAIJ 15AB LHCb pp at 7, 8 TeV

61 ± 15 ± 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=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 ± 8 ± 9 10k ¹ AAIJ 15AB LHCb pp at 7, 8 TeV

70⁺³⁰₋₂₀ ± 30 2.6k AALTONEN 14l CDF $p\bar{p}$ at 1.96 TeV

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

56 ± 7 ± 9 10k ² AAIJ 15AB LHCb pp at 7, 8 TeV

82 ± 10 ± 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

NODE=M248215;NODE=M248

Mode	Fraction (Γ_i/Γ)
Γ_1 $B\pi$	possibly seen
Γ_2 $B^*\pi$	seen

DESIG=1
DESIG=2

 $B_J(5970)$ BRANCHING RATIOS

NODE=M248220

 $\Gamma(B\pi)/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
possibly seen	2k	¹ AAIJ	15AB LHCb	±	pp at 7, 8 TeV
possibly seen	10k	¹ AAIJ	15AB LHCb	0	pp at 7, 8 TeV
possibly seen	2.6k	AALTONEN	14l CDF	0	$p\bar{p}$ at 1.96 TeV
possibly seen	1.4k	AALTONEN	14l CDF	±	$p\bar{p}$ at 1.96 TeV

¹ A $B\pi$ decay is forbidden from a $P = -(-1)^J$ parent, whereas $B^*\pi$ is allowed.

NODE=M248R01
NODE=M248R01

OCCUR=2

OCCUR=2

NODE=M248R01;LINKAGE=A

 $\Gamma(B^*\pi)/\Gamma_{\text{total}}$ **Γ_2/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	CHG	COMMENT
seen	10k	AAIJ	15AB LHCb	0	pp at 7, 8 TeV
seen	2k	AAIJ	15AB LHCb	±	pp at 7, 8 TeV
seen	2.6k	AALTONEN	14l CDF	0	$p\bar{p}$ at 1.96 TeV
seen	1.4k	AALTONEN	14l CDF	±	$p\bar{p}$ at 1.96 TeV

NODE=M248R02
NODE=M248R02

OCCUR=2

OCCUR=2

 $B_J(5970)$ REFERENCES

NODE=M248

AAIJ 15AB JHEP 1504 024
AALTONEN 14l PR D90 012013

R. Aaij *et al.*
T. Aaltonen *et al.*

(LHCb Collab.)
(CDF Collab.)

REFID=56628
REFID=56029

BOTTOM, STRANGE MESONS

($B = \pm 1, S = \mp 1$)

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \text{ similarly for } B_s^{*\prime}s$$

X(5568) $^\pm$

$$I(J^P) = ?(??)$$

OMITTED FROM SUMMARY TABLE

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.

X(5568) $^\pm$ 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 $\pm 2.9^{+0.9}_{-1.9}$	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 $X(5568)^\pm \rightarrow B_s\pi^\pm$ decay. If $X(5568)^\pm \rightarrow B_s^*\pi^\pm$ decay is assumed, the mass shifts upward by 49 MeV.				

X(5568) $^\pm$ 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 $\pm 6.4^{+5.0}_{-2.5}$	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.				

X(5568) $^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad B_s\pi^\pm$	seen

$\Gamma(B_s\pi^\pm)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_1/Γ
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	$pp \rightarrow B_s^0\pi^\pm X$	

¹ With B_s mesons reconstructed in decays to $D_s^\pm\mu^\mp X$.

² 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, $X(5568)^\pm \rightarrow B_s^*\pi^\pm$ with a missing γ , could not be ruled out.

NODE=MXXX046

NODE=MXXX046

NODE=M232

NODE=M232

NODE=M232M

NODE=M232M

NODE=M232M;LINKAGE=B

NODE=M232M;LINKAGE=A

NODE=M232W

NODE=M232W

NODE=M232W;LINKAGE=B

NODE=M232215;NODE=M232

DESIG=1

NODE=M232R01

NODE=M232R01

OCCUR=2

NODE=M232R01;LINKAGE=F

NODE=M232R01;LINKAGE=A

- 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 $X(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.5% at $p_T(B_s) > 10 \text{ GeV}/c$ and less than 1.6% at $p_T(B_s) > 15 \text{ GeV}/c$ at 95% CL.
- ⁴ Not seen in 9.6 fb^{-1} of $p\bar{p}$ collision data at $\sqrt{s} = 1.96 \text{ TeV}$ with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $X(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 6.7% at 95% CL.
- ⁵ Not seen in 19.7 fb^{-1} of pp collisions data at $\sqrt{s} = 8 \text{ TeV}$ with B_s mesons reconstructed in decays to $J/\psi\phi$. An upper limit on the production rate times branching fraction for $X(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 1.1% at $p_T(B_s) > 10 \text{ GeV}/c$ and less than 1.0% at $p_T(B_s) > 15 \text{ GeV}/c$ at 95%CL.
- ⁶ Not seen in 3 fb^{-1} of pp collision data at $\sqrt{s} = 7$ and 8 TeV in a scan over the $X(5568)$ mass and width, with B_s mesons reconstructed in decays to $D_s^- \pi^+$ or $J/\psi\phi$. An upper limit on the production rate times branching fraction for $X(5568)^\pm \rightarrow B_s \pi^\pm$ relative to inclusive B_s production is less than 2.1% at $p_T(B_s) > 10 \text{ GeV}/c$ at 90% CL.

NODE=M232R01;LINKAGE=E

NODE=M232R01;LINKAGE=D

NODE=M232R01;LINKAGE=C

NODE=M232R01;LINKAGE=B

 $X(5568)^\pm$ REFERENCES

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.)

NODE=M232

REFID=58829
REFID=58828
REFID=58937
REFID=58827
REFID=57549
REFID=57453

$$B_{s1}(5830)^0$$

$$I(J^P) = 0(1^+)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

NODE=M187

NODE=M187

 $B_{s1}(5830)^0$ MASS

NODE=M187M

NODE=M187M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
5828.70$\pm$0.20 OUR FIT			
5828.65$\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 $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M187M;LINKAGE=AI
NODE=M187M;LINKAGE=AA

$$m_{B_{s1}^0} - m_{B^{*+}}$$

NODE=M187DM

NODE=M187DM

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
504.00$\pm$0.17 OUR FIT			
504.03$\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 $m_{B_{s1}(5830)^0} - m_{B^{*+}} - m_{K^-} = 10.35 \pm 0.12 \pm 0.15 \text{ MeV}$ 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 $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M187DM;LINKAGE=AL

NODE=M187DM;LINKAGE=AA

 $B_{s1}(5830)^0$ WIDTH

NODE=M187W

NODE=M187W

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

NODE=M187215;NODE=M187

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^{*+} K^-$	seen
Γ_2 $B^{*0} K_S^0$	

DESIG=1
DESIG=2 **$B_{s1}(5830)^0$ BRANCHING RATIOS**

NODE=M187220

$\Gamma(B^{*+} K^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID TECN COMMENT
seen	AALTONEN 08K CDF $p\bar{p}$ at 1.96 TeV

NODE=M187R01
NODE=M187R01

$\Gamma(B^{*0} K_S^0)/\Gamma(B^{*+} K^-)$	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

NODE=M187R00
NODE=M187R00

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=M187R00;LINKAGE=A

 $B_{s1}(5830)^0$ 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 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
5839.86 $\pm$ 0.12 OUR 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 14I
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

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 14I
¹ Uses two-body decays into K^- and B^+ mesons reconstructed as $B^+ \rightarrow J/\psi K^+$, $J/\psi \rightarrow \mu^+ \mu^-$ or $B^+ \rightarrow \bar{D}^0 \pi^+$, $\bar{D}^0 \rightarrow K^+ \pi^-$.			

NODE=M186DM

NODE=M186DM;LINKAGE=AA

$$m_{B_{s2}^{*0}} - m_{B^+}$$

NODE=M186DM2

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
560.52 $\pm$ 0.14 OUR FIT			
560.41 $\pm$ 0.13 $\pm$ 0.14	¹ AALTONEN	14I CDF	$p\bar{p}$ at 1.96 TeV

NODE=M186DM2

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;LINKAGE=AL

$B_{s2}^*(5840)^0$ WIDTH

NODE=M186W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1.49±0.27 OUR AVERAGE			
1.52±0.34±0.30	SIRUNYAN	18DF CMS	$p\bar{p}$ at 8 TeV
1.4 ±0.4 ±0.2	AALTONEN	14l CDF	$p\bar{p}$ at 1.96 TeV
1.56±0.13±0.47	¹ AAIJ	130 LHCb	$p\bar{p}$ at 7 TeV
¹ Uses $B_{s2}^*(5840)^0 \rightarrow B^{*+} K^-$ decays.			

NODE=M186W

NODE=M186W;LINKAGE=A1

$B_{s2}^*(5840)^0$ DECAY MODES

NODE=M186215;NODE=M186

Mode	Fraction (Γ_i/Γ)
Γ_1 $B^+ K^-$	DEFINED AS 1
Γ_2 $B^{*+} K^-$	0.093±0.018
Γ_3 $B^0 K_S^0$	0.43 ±0.11
Γ_4 $B^{*0} K_S^0$	0.04 ±0.04

DESIG=1

DESIG=2

DESIG=4

DESIG=3

$B_{s2}^*(5840)^0$ BRANCHING RATIOS

NODE=M186220

$\Gamma(B^+ K^-)/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	
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=M186R01
NODE=M186R01

NODE=M186R01;LINKAGE=AB

$\Gamma(B^{*+} K^-)/\Gamma(B^+ K^-)$	Γ_2/Γ_1
VALUE	
0.093±0.013±0.012	AAIJ 130 LHCb $p\bar{p}$ at 7 TeV

NODE=M186R02
NODE=M186R02

$\Gamma(B^{*0} K_S^0)/\Gamma(B^0 K_S^0)$	Γ_4/Γ_3
VALUE	
0.093±0.086±0.014	¹ SIRUNYAN 18DF CMS $p\bar{p}$ 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

$\Gamma(B^0 K_S^0)/\Gamma(B^+ K^-)$	Γ_3/Γ_1
VALUE	
0.432±0.077±0.078	¹ SIRUNYAN 18DF CMS $p\bar{p}$ 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	
0.081±0.021±0.015	¹ SIRUNYAN 18DF CMS $p\bar{p}$ 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

NODE=M186

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	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.)

REFID=59328
REFID=56029
REFID=54968
REFID=52235
REFID=52232

$B_{sJ}^*(5850)$
 $I(J^P) = ?(??)$
 I, J, P need confirmation.

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

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
5853 ± 15	141	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

NODE=M153M

NODE=M153M

 $B_{sJ}^*(5850)$ WIDTH

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
47 ± 22	141	AKERS	95E OPAL	$E_{cm}^{ee} = 88-94$ GeV

NODE=M153W

NODE=M153W

 $B_{sJ}^*(5850)$ REFERENCESAKERS 95E ZPHY C66 19 R. Akers *et al.* (OPAL Collab.)

NODE=M153

REFID=44182

BOTTOM, CHARMED MESONS

($B = C = \pm 1$)

 $B_c^+ = c\bar{b}, B_c^- = \bar{c}b,$ similarly for B_c^{*} 's

NODE=MXXX049

NODE=MXXX049

NODE=M217

 $B_c(2S)^\pm$
 $I(J^P) = 0(0^-)$

OMITTED FROM SUMMARY TABLE

Quantum numbers neither measured nor confirmed.

NODE=M217

 $B_c(2S)^\pm$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
6871.2 ± 1.0 OUR AVERAGE				
[6871.6 ± 1.1 MeV OUR 2020 AVERAGE]				
6871.7 ± 1.3 ± 0.3	24	^{1,2} AAIJ	19Y LHCb	pp at 7, 8, 13 TeV
6870.6 ± 1.4 ± 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

NODE=M217M

NODE=M217M
NEWSYCLP=A
SYCLP=A

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.

NODE=M217M;LINKAGE=E

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 $M(B_c^+)$.

NODE=M217M;LINKAGE=F

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.

NODE=M217M;LINKAGE=B

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 $M(B_c^+)$.

NODE=M217M;LINKAGE=D

⁵ AAIJ 18AL reports an upper limit on the ratio of production cross sections for $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04\text{--}0.09$ 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 $B_c^*(2S)$.

NODE=M217M;LINKAGE=A

NODE=M217M;LINKAGE=AA

NODE=M217M;LINKAGE=C

NODE=M217215;NODE=M217

DESIG=1

NODE=M217225

NODE=M217R01
NODE=M217R01

NODE=M217R01;LINKAGE=AA
NODE=M217R01;LINKAGE=A

NODE=M217

REFID=59795
REFID=59639
REFID=59246
REFID=56117

$B_c(2S)^\pm$ DECAY MODES

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	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 $[\sigma(B_c(2S)^+)/\sigma(B_c^+)] \cdot B(B_c(2S)^+ \rightarrow B_c^+ \pi^+ \pi^-) < 0.04\text{--}0.09$ at 95% CL for the mass value reported by AAD 14AQ.

$B_c(2S)^\pm$ REFERENCES

AAIJ	19Y	PRL 122 232001	R. Aaij <i>et al.</i>	(LHCb Collab.)
SIRUNYAN	19M	PRL 122 132001	A.M. Sirunyan <i>et al.</i>	(CMS Collab.)
AAIJ	18AL	JHEP 1801 138	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAD	14AQ	PRL 113 212004	G. Aad <i>et al.</i>	(ATLAS Collab.)

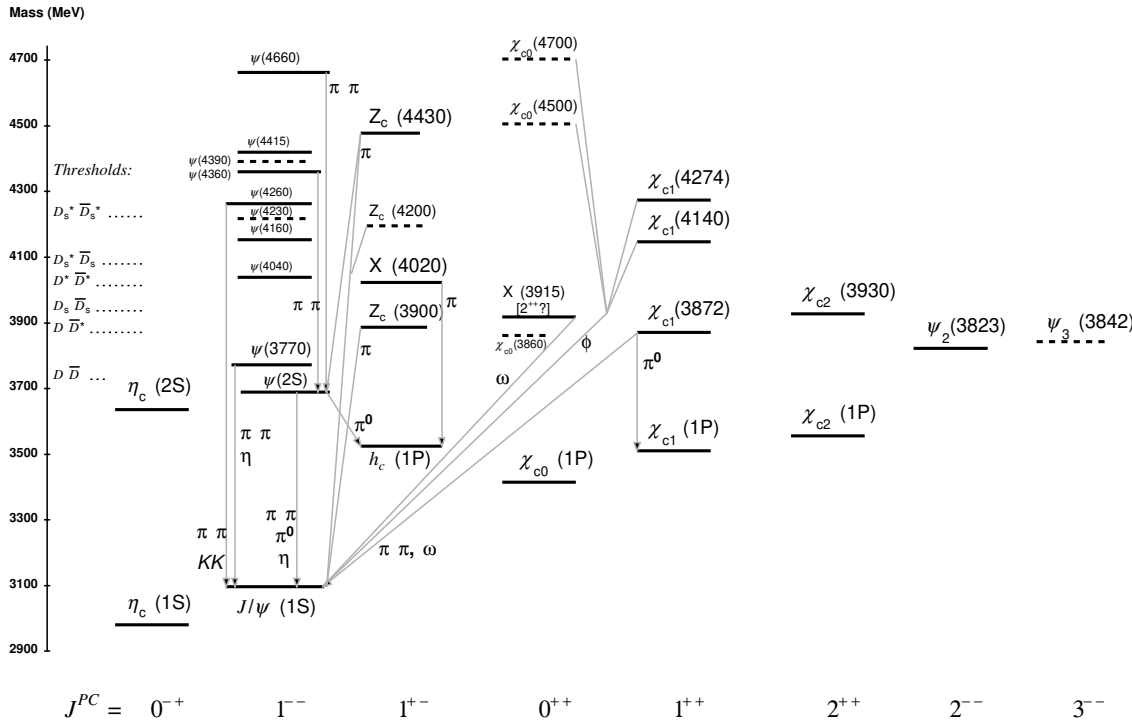
See the related review(s):
[Spectroscopy of Mesons Containing Two Heavy Quarks](#)

$c\bar{c}$ MESONS
(including possibly non- $q\bar{q}$ states)

NODE=MXXX025

NODE=M826

Updated August 2019.



The level scheme of meson states containing a minimal quark content of $c\bar{c}$. The name of a state is determined by its quantum numbers $I^G J^{PC}$ (see the review “Naming Scheme for Hadrons”). States with unestablished quantum numbers are called X and are drawn according to our best estimate of their likely J^{PC} . States included in the Summary Tables are shown with solid lines; selected states not in the Summary Tables, but with assigned quantum numbers, are shown with dotted lines. The arrows indicate the most dominant hadronic transitions. Single photon transitions, including $\psi(nS) \rightarrow \gamma \eta_c(mS)$, $\psi(nS) \rightarrow \gamma \chi_{cJ}(1P)$, and $\chi_{cJ}(1P) \rightarrow \gamma J/\psi$, are omitted for clarity. For orientation, the location of the thresholds related to a pair of ground state open charm mesons is indicated in the figure.

$\eta_c(1S)$	$I^G(J^{PC}) = 0^+(0^-+)$

NODE=M026

$\eta_c(1S)$ MASS

NODE=M026M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
2983.9 ± 0.4 OUR AVERAGE		Error includes scale factor of 1.2. [2983.9 ± 0.5 MeV]		
OUR 2020 AVERAGE Scale factor = 1.3]				
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	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$

NODE=M026M

NEW

2982.2 ± 1.5 ± 0.1	2.0k	4	AAIJ	15BI	LHCB	$p\bar{p} \rightarrow \eta_c(1S)X$	
2983.5 ± 1.4 ± 1.6 3.6		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	$\gamma\gamma \rightarrow K^+K^-\eta$	OCCUR=2
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	$\psi(2S) \rightarrow \pi^0\gamma$ 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 2.0	920	10	VINOKUROVA	11	BELL	$B^\pm \rightarrow K_S^0 K^\pm \pi^\mp$	
2982.2 ± 0.4 ± 1.6	14k	11	LEES	10	BABR	$10.6 e^+e^- \rightarrow K_S^0 K^\pm \pi^\mp$	
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	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons	
2970 ± 5 ± 6	501	12	ABE	07	BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$	
2971 ± 3 ± 2 1	195		WU	06	BELL	$B^+ \rightarrow p\bar{p}K^+$	
2974 ± 7 ± 2 1	20		WU	06	BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$	OCCUR=2
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	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	OCCUR=2
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	$J/\psi \rightarrow \gamma\eta_c$	OCCUR=2
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 - 3.1			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	$J/\psi \rightarrow \gamma K^+K^-K_S^0K_L^0$	OCCUR=3
2982.6 ± 2.7 - 2.3	12		BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma\gamma$	
2980.2 ± 1.6		15,23	BALTRUSAIT..	86	MRK3	$J/\psi \rightarrow \eta_c \gamma$	
2984 ± 2.3 ± 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.							NODE=M026M;LINKAGE=H
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.							NODE=M026M;LINKAGE=F
³ From a fit of the $\phi\phi$ invariant mass with the mass and width of $\eta_c(1S)$ as free parameters.							NODE=M026M;LINKAGE=G
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.							NODE=M026M;LINKAGE=D
⁵ Taking into account an asymmetric photon lineshape.							NODE=M026M;LINKAGE=E
⁶ With floating width.							NODE=M026M;LINKAGE=AL
⁷ Ignoring possible interference with the non-resonant 0^- amplitude.							NODE=M026M;LINKAGE=L

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=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
32.0 ± 0.7 OUR FIT				
32.1 ± 0.8 OUR AVERAGE				Error includes scale factor of 1.1.
33.8 ± 1.6 ± 4.1	1705	ABLIKIM	19AV BES3	$J/\psi \rightarrow \gamma\omega\omega$
30.8 $^{+2.3}_{-2.2}$ ± 2.9	2673	XU	18 BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
34.0 ± 1.9 ± 1.3	11k	AAIJ	17AD LHCb	$pp \rightarrow B^+X \rightarrow p\bar{p}K^+X$
31.4 ± 3.5 ± 2.0	6.4k	¹ AAIJ	17BB LHCb	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
27.2 ± 3.1 $^{+5.4}_{-2.6}$		² ANASHIN	14 KEDR	$J/\psi \rightarrow \gamma\eta_c$
25.2 ± 2.6 ± 2.4	4.5k	^{3,4} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
34.8 ± 3.1 ± 4.0	900	^{3,4,5} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
32.0 ± 1.2 ± 1.0		^{6,7} ABLIKIM	12F BES3	$\psi(2S) \rightarrow \gamma\eta_c$
36.4 ± 3.2 ± 1.7	832	³ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma$ hadrons
37.8 $^{+5.8}_{-5.3}$ ± 3.1	486	ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
36.2 ± 2.8 ± 3.0	11k	DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
35.1 ± 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 ± 1.2 ± 0.8	14k	⁸ LEES	10 BABR	$10.6 e^+e^- \rightarrow e^+e^-K_S^0 K^\pm\pi^\mp$
36.3 $^{+3.7}_{-3.6}$ ± 4.4	0.9k	AUBERT	08AB BABR	$B \rightarrow \eta_c(1S)K(*) \rightarrow K\bar{K}\pi K(*)$
28.1 ± 3.2 ± 2.2	7.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c \rightarrow$ hadrons
48 $^{+8}_{-7}$ ± 5	195	WU	06 BELL	$B^+ \rightarrow p\bar{p}K^+$
40 ± 19 ± 5	20	WU	06 BELL	$B^+ \rightarrow \Lambda\bar{\Lambda}K^+$
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	$\gamma\gamma \rightarrow K_S^0 K^\pm\pi^\mp$
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^-

OCCUR=2

OCCUR=2

OCCUR=2

- 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)	Confidence level
Decays involving hadronic resonances		
$\Gamma_1 \quad \eta'(958)\pi\pi$	(4.1 $\pm$ 1.7) %	
$\Gamma_2 \quad \rho\rho$	(1.8 $\pm$ 0.5) %	
$\Gamma_3 \quad K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 $\pm$ 0.7) %	
$\Gamma_4 \quad K^*(892) \bar{K}^*(892)$	(7.0 $\pm$ 1.3) $\times 10^{-3}$	
$\Gamma_5 \quad K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.1 $\pm$ 0.5) %	
$\Gamma_6 \quad \phi K^+ K^-$	(2.9 $\pm$ 1.4) $\times 10^{-3}$	
$\Gamma_7 \quad \phi\phi$	(1.77 $\pm$ 0.19) $\times 10^{-3}$	
$\Gamma_8 \quad \phi 2(\pi^+ \pi^-)$	< 4 $\times 10^{-3}$	90%
$\Gamma_9 \quad a_0(980)\pi$	< 2 %	90%
$\Gamma_{10} \quad a_2(1320)\pi$	< 2 %	90%
$\Gamma_{11} \quad K^*(892) \bar{K} + \text{c.c.}$	< 1.28 %	90%
$\Gamma_{12} \quad f_2(1270)\eta$	< 1.1 %	90%
$\Gamma_{13} \quad \omega\omega$	(2.9 $\pm$ 0.8) $\times 10^{-3}$	
$\Gamma_{14} \quad \omega\phi$	< 2.5 $\times 10^{-4}$	90%
$\Gamma_{15} \quad f_2(1270) f_2(1270)$	(9.8 $\pm$ 2.5) $\times 10^{-3}$	
$\Gamma_{16} \quad f_2(1270) f'_2(1525)$	(9.7 $\pm$ 3.2) $\times 10^{-3}$	
$\Gamma_{17} \quad f_0(980)\eta$	seen	
$\Gamma_{18} \quad f_0(1500)\eta$	seen	
$\Gamma_{19} \quad f_0(2200)\eta$	seen	
$\Gamma_{20} \quad a_0(980)\pi$	seen	
$\Gamma_{21} \quad a_0(1320)\pi$	seen	
$\Gamma_{22} \quad a_0(1450)\pi$	seen	
$\Gamma_{23} \quad a_0(1950)\pi$	seen	
$\Gamma_{24} \quad K_0^*(1430) \bar{K}$	seen	
$\Gamma_{25} \quad K_2^*(1430) \bar{K}$	seen	
$\Gamma_{26} \quad K_0^*(1950) \bar{K}$	seen	
Decays into stable hadrons		
$\Gamma_{27} \quad K \bar{K} \pi$	(7.3 $\pm$ 0.4) %	
$\Gamma_{28} \quad K \bar{K} \eta$	(1.36 $\pm$ 0.15) %	
$\Gamma_{29} \quad \eta \pi^+ \pi^-$	(1.7 $\pm$ 0.5) %	
$\Gamma_{30} \quad \eta 2(\pi^+ \pi^-)$	(4.4 $\pm$ 1.3) %	
$\Gamma_{31} \quad K^+ K^- \pi^+ \pi^-$	(6.9 $\pm$ 1.0) $\times 10^{-3}$	
$\Gamma_{32} \quad K^+ K^- \pi^+ \pi^- \pi^0$	(3.5 $\pm$ 0.6) %	
$\Gamma_{33} \quad K^0 K^- \pi^+ \pi^- \pi^+ + \text{c.c.}$	(5.6 $\pm$ 1.5) %	
$\Gamma_{34} \quad K^+ K^- 2(\pi^+ \pi^-)$	(7.5 $\pm$ 2.4) $\times 10^{-3}$	
$\Gamma_{35} \quad 2(K^+ K^-)$	(1.46 $\pm$ 0.30) $\times 10^{-3}$	
$\Gamma_{36} \quad \pi^+ \pi^- \pi^0$	< 5 $\times 10^{-4}$	90%
$\Gamma_{37} \quad \pi^+ \pi^- \pi^0 \pi^0$	(4.7 $\pm$ 1.0) %	

NODE=M026;CLUMP=A
 DESIG=24
 DESIG=19
 DESIG=26
 DESIG=18
 DESIG=57
 DESIG=28
 DESIG=17
 DESIG=58
 DESIG=21
 DESIG=22
 DESIG=40
 DESIG=23
 DESIG=20
 DESIG=47
 DESIG=46
 DESIG=59
 DESIG=70
 DESIG=71
 DESIG=72
 DESIG=73
 DESIG=74
 DESIG=75
 DESIG=79
 DESIG=76
 DESIG=77
 DESIG=78

NODE=M026;CLUMP=B
 DESIG=14
 DESIG=25
 DESIG=16
 DESIG=61
 DESIG=15
 DESIG=60
 DESIG=62
 DESIG=55
 DESIG=27
 DESIG=81
 DESIG=63

Γ_{38}	$2(\pi^+\pi^-)$	$(9.7 \pm 1.2) \times 10^{-3}$	DESIG=11
Γ_{39}	$2(\pi^+\pi^-\pi^0)$	$(16.1 \pm 2.0) \%$	DESIG=64
Γ_{40}	$3(\pi^+\pi^-)$	$(1.8 \pm 0.4) \%$	DESIG=56
Γ_{41}	$\rho\bar{\rho}$	$(1.45 \pm 0.14) \times 10^{-3}$	DESIG=12
Γ_{42}	$\rho\bar{\rho}\pi^0$	$(3.6 \pm 1.3) \times 10^{-3}$	DESIG=65
Γ_{43}	$\Lambda\bar{\Lambda}$	$(1.07 \pm 0.24) \times 10^{-3}$	DESIG=45
Γ_{44}	$K^+\bar{p}\Lambda + \text{c.c.}$	$(2.5 \pm 0.4) \times 10^{-3}$	DESIG=82
Γ_{45}	$\bar{\Lambda}(1520)\Lambda + \text{c.c.}$	$(3.1 \pm 1.4) \times 10^{-3}$	DESIG=83
Γ_{46}	$\Sigma^+\bar{\Sigma}^-$	$(2.1 \pm 0.6) \times 10^{-3}$	DESIG=66
Γ_{47}	$\Xi^-\bar{\Xi}^+$	$(9.0 \pm 2.6) \times 10^{-4}$	DESIG=67
Γ_{48}	$\pi^+\pi^-\rho\bar{\rho}$	$(5.3 \pm 1.8) \times 10^{-3}$	DESIG=13

Radiative decays

Γ_{49}	$\gamma\gamma$	$(1.58 \pm 0.11) \times 10^{-4}$	DESIG=31

NODE=M026;CLUMP=C
DESIG=31

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

NODE=M026;CLUMP=D

Γ_{50}	$\pi^+\pi^-$	$P, CP < 1.1$	$\times 10^{-4}$	90%	DESIG=51
Γ_{51}	$\pi^0\pi^0$	$P, CP < 4$	$\times 10^{-5}$	90%	DESIG=52
Γ_{52}	K^+K^-	$P, CP < 6$	$\times 10^{-4}$	90%	DESIG=53
Γ_{53}	$K_S^0\bar{K}_S^0$	$P, CP < 3.1$	$\times 10^{-4}$	90%	DESIG=54

CONSTRAINED FIT INFORMATION

An overall fit to the total width, 8 combinations of partial widths obtained from integrated cross section, and 19 branching ratios uses 93 measurements and one constraint to determine 13 parameters. The overall fit has a $\chi^2 = 121.6$ for 81 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	15									
x_{15}	3	5								
x_{27}	17	33	6							
x_{28}	7	15	3	45						
x_{31}	9	17	3	19	9					
x_{35}	7	12	2	20	9	8				
x_{38}	11	21	4	24	11	13	9			
x_{41}	10	19	3	25	11	11	9	14		
x_{43}	2	4	1	6	3	3	2	3	23	
x_{49}	-26	-49	-9	-56	-25	-30	-22	-37	-36	-8
Γ	-1	-2	0	-3	-1	-2	-1	-2	6	1
	x_4	x_7	x_{15}	x_{27}	x_{28}	x_{31}	x_{35}	x_{38}	x_{41}	x_{43}
Γ	-29									
	x_{49}									

Mode	Rate (MeV)	
Γ_4	$K^*(892)\bar{K}^*(892)$	0.22 $\pm$ 0.04
Γ_7	$\phi\phi$	0.057 $\pm$ 0.006
Γ_{15}	$f_2(1270)f_2(1270)$	0.31 $\pm$ 0.08
Γ_{27}	$K\bar{K}\pi$	2.33 $\pm$ 0.13
Γ_{28}	$K\bar{K}\eta$	0.43 $\pm$ 0.05
Γ_{31}	$K^+K^-\pi^+\pi^-$	0.220 $\pm$ 0.034
Γ_{35}	$2(K^+K^-)$	0.047 $\pm$ 0.010
Γ_{38}	$2(\pi^+\pi^-)$	0.31 $\pm$ 0.04
Γ_{41}	$\rho\bar{\rho}$	0.046 $\pm$ 0.005
Γ_{43}	$\Lambda\bar{\Lambda}$	0.034 $\pm$ 0.008
Γ_{49}	$\gamma\gamma$	0.00506 $\pm$ 0.00034

DESIG=18
DESIG=17
DESIG=46
DESIG=14
DESIG=25
DESIG=15
DESIG=27
DESIG=11
DESIG=12
DESIG=45
DESIG=31

$\eta_c(1S)$ PARTIAL WIDTHS

NODE=M026217

 $\Gamma(\gamma\gamma)$ Γ_{49}

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.06 ± 0.34 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.8 ± 1.1	486	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
5.2 ± 1.2	273 ± 43	^{2,3} AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
5.5 ± 1.2 ± 1.8 ± 33		⁴ KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$
7.4 ± 0.4 ± 2.3		⁵ ASNER	04 CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
13.9 ± 2.0 ± 3.0	41	⁶ ABDALLAH	03J DLPH	$\gamma\gamma \rightarrow \eta_c$
3.8 $\begin{smallmatrix} +1.1 \\ -1.0 \end{smallmatrix}$ $\begin{smallmatrix} +1.9 \\ -1.0 \end{smallmatrix}$	190	⁷ AMBROGIANI	03 E835	$\bar{p}p \rightarrow \eta_c \rightarrow \gamma\gamma$
7.6 ± 0.8 ± 2.3		^{5,8} BRANDENB...	00B CLE2	$\gamma\gamma \rightarrow \eta_c \rightarrow K^\pm K_S^0 \pi^\mp$
6.9 ± 1.7 ± 2.1	76	⁹ ACCIARRI	99T L3	$e^+e^- \rightarrow e^+e^-\eta_c$
27 ± 16 ± 10	5	⁵ SHIRAI	98 AMY	58 e^+e^-
6.7 $\begin{smallmatrix} +2.4 \\ -1.7 \end{smallmatrix}$ ± 2.3		⁴ ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$
11.3 ± 4.2		¹⁰ ALBRECHT	94H ARG	$e^+e^- \rightarrow e^+e^-\eta_c$
8.0 ± 2.3 ± 2.4	17	¹¹ ADRIANI	93N L3	$e^+e^- \rightarrow e^+e^-\eta_c$
5.9 $\begin{smallmatrix} +2.1 \\ -1.8 \end{smallmatrix}$ ± 1.9		⁷ CHEN	90B CLEO	$e^+e^- \rightarrow e^+e^-\eta_c$
6.4 $\begin{smallmatrix} +5.0 \\ -3.4 \end{smallmatrix}$		¹² AIHARA	88D TPC	$e^+e^- \rightarrow e^+e^-X$
4.3 $\begin{smallmatrix} +3.4 \\ -3.7 \end{smallmatrix}$ ± 2.4		⁴ BAGLIN	87B SPEC	$\bar{p}p \rightarrow \gamma\gamma$
28 ± 15		^{5,13} BERGER	86 PLUT	$\gamma\gamma \rightarrow K\bar{K}\pi$

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 $B(\eta_c \rightarrow p\bar{p}) = (1.3 \pm 0.4) \times 10^{-3}$.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

 $\eta_c(1S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M026220

 $\Gamma(\eta'(958)\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
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 $\begin{smallmatrix} +6.3 \\ -6.2 \end{smallmatrix}$ ± 8.4	486	¹ ZHANG	12A BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$

¹ Superseded by XU 18.

NODE=M026G10;LINKAGE=A

 $\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{49}/\Gamma$

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	$\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

 $\Gamma(K^*(892)\bar{K}^*(892)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_{49}/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

36 ± 6 OUR FIT

32.4 ± 4.2 ± 5.8	882 ± 115	UEHARA	08 BELL	$\gamma\gamma \rightarrow \pi^+ \pi^- K^+ K^-$

NODE=M026G09

NODE=M026G09

NODE=M026G08

NODE=M026G08

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

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

9.0 ± 0.8 OUR 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 $\gamma\gamma \rightarrow 2(K^+ K^-)$
¹Supersedes UEHARA 08. Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$.

NODE=M026G07
NODE=M026G07

NODE=M026G07;LINKAGE=LI

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

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

8.67 ± 2.86 ± 0.96 85 ± 29 ¹ LIU 12B BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^- \pi^0)$
¹Using $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M026G03
NODE=M026G03

NODE=M026G03;LINKAGE=LI

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

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 $\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
¹Using $B(\phi \rightarrow K^+ K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+ \pi^- \pi^0) = (89.2 \pm 0.7)\%$.

NODE=M026G04
NODE=M026G04

NODE=M026G04;LINKAGE=LI

 $\Gamma(f_2(1270)f_2(1270)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

50 ± 13 OUR FIT
69 ± 17 ± 12 3182 ± 766 UEHARA 08 BELL $\gamma\gamma \rightarrow 2(\pi^+ \pi^-)$

NODE=M026G19
NODE=M026G19

 $\Gamma(f_2(1270)f_2'(1525)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

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

 $\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

VALUE (keV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.369 ± 0.020 OUR FIT
0.407 ± 0.027 OUR AVERAGE Error includes scale factor of 1.2.

0.374 ± 0.009 ± 0.031 14k ¹ LEES 10 BABR $10.6 e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp$

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. • • •

0.386 ± 0.008 ± 0.021 12k ⁵ DEL-AMO-SA...11M BABR $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

0.418 ± 0.044 ± 0.022 ^{3,6} 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 $\gamma\gamma \rightarrow K\bar{K}\pi$
¹From the corrected and unfolded mass spectrum.

²Calculated by us from the value reported in ASNER 04 that assumes $B(\eta_c \rightarrow K\bar{K}\pi) = 5.5 \pm 1.7\%$
³We have multiplied $K^\pm K_S^0 \pi^\mp$ measurement by 3 to obtain $K\bar{K}\pi$.

⁴Calculated by us from the value reported in ABDALLAH 03J, which uses $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) = (1.5 \pm 0.4)\%$.

⁵Not independent from the measurements reported by LEES 10.

⁶Superseded by ASNER 04.

NODE=M026G14;LINKAGE=LE
NODE=M026G14;LINKAGE=AA

NODE=M026G14;LINKAGE=C
NODE=M026G;LINKAGE=BB

NODE=M026G14;LINKAGE=DE
NODE=M026G14;LINKAGE=NN

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{31}\Gamma_{49}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
35 ± 5 OUR FIT				
27 ± 6 OUR AVERAGE				
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=M026G15
NODE=M026G15

NODE=M026G;LINKAGE=CC

$$\Gamma(K^+K^-\pi^+\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{32}\Gamma_{49}/\Gamma$$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.190 ± 0.006 ± 0.028	11k	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^0$

¹ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M026G02
NODE=M026G02

NODE=M026G02;LINKAGE=DE

$$\Gamma(2(K^+K^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{35}\Gamma_{49}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.4 ± 1.5 OUR FIT				
5.8 ± 1.9 OUR AVERAGE				
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 $B(\eta_c \rightarrow 2(K^+K^-)) = (2.1 \pm 1.2)\%$.

² Includes all topological modes except $\eta_c \rightarrow \phi\phi$.

NODE=M026G27
NODE=M026G27

NODE=M026G;LINKAGE=DD

NODE=M026G;LINKAGE=EE

$$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{38}\Gamma_{49}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 6 OUR 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

$$\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{41}\Gamma_{49}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
7.4 ± 0.7 OUR FIT				
7.20 ± 1.53^{+0.67}_{-0.75}	157 ± 33	¹ KUO	05 BELL	$\gamma\gamma \rightarrow p\bar{p}$

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

4.6 ^{+1.3} _{-1.1} ± 0.4	190	¹ AMBROGIANI	03 E835	$\bar{p}p \rightarrow \gamma\gamma$
8.1 ^{+2.9} _{-2.0}		¹ ARMSTRONG	95F E760	$\bar{p}p \rightarrow \gamma\gamma$

¹ Not independent from the $\Gamma_{\gamma\gamma}$ reported by the same experiment.

NODE=M026G01
NODE=M026G01

NODE=M026G01;LINKAGE=GG

$$\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{53}\Gamma_{49}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	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. • • •				
<0.29	90	² UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$

¹ Taking into account interference with the non-resonant continuum.

² Neglecting interference with the non-resonant continuum.

NODE=M026G05
NODE=M026G05

OCCUR=2

NODE=M026G05;LINKAGE=U1
NODE=M026G05;LINKAGE=U2

$\eta_c(1S)$ BRANCHING RATIOS

NODE=M026225

HADRONIC DECAYS

NODE=M026305

$$\Gamma(\eta'(958)\pi\pi)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.041 ± 0.017	14	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R14
NODE=M026R14

NODE=M026R14;LINKAGE=E

$\Gamma(\rho\rho)/\Gamma_{\text{total}}$ Γ_2/Γ VALUE (units 10^{-3}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

18 ± 5 OUR AVERAGE

12.6 ± 3.8 ± 5.1	72	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^+ \pi^- \gamma$
26.0 ± 2.4 ± 8.8	113	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^0 \rho^0$
23.6 ± 10.6 ± 8.2	32	¹ BISELLO	91 DM2	$J/\psi \rightarrow \gamma \rho^+ \rho^-$

NODE=M026R9
NODE=M026R9

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

<14 90 ¹ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ ¹ 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.

OCCUR=2

NODE=M026R9;LINKAGE=E

 $\Gamma(K^*(892)^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE EVTS

DOCUMENT ID

TECN

COMMENT

0.02 ± 0.007

63

^{1,2} BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ ¹ BALTRUSAITIS 86 has an error according to Partridge.² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.NODE=M026R16
NODE=M026R16

NODE=M026R;LINKAGE=03

NODE=M026R16;LINKAGE=E

 $\Gamma(K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_4/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

70 ± 13 OUR FIT**91 ± 26 OUR AVERAGE**

108 ± 25 ± 44	60	¹ ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
82 ± 28 ± 27	14	¹ BISELLO	91 DM2	$e^+ e^- \rightarrow \gamma K^+ K^- \pi^+ \pi^-$
90 ± 50	9	¹ BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$

¹ 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=M026R8
NODE=M026R8

NODE=M026R8;LINKAGE=E

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

113 ± 47 ± 24

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R25
NODE=M026R25

NODE=M026R25;LINKAGE=AB

 $\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_6/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

2.9^{+0.9}_{-0.8} ± 1.114.1^{+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

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

17.7 ± 1.9 OUR FIT**28 ± 4 OUR AVERAGE**

26 ⁺⁴ ₋₈ ± 5	1.2k	¹ ABLIKIM	17P BES3	$J/\psi \rightarrow K^+ K^- K^+ K^- \gamma$
25.3 ± 5.1 ± 9.1	72	² ABLIKIM	05L BES2	$J/\psi \rightarrow K^+ K^- K^+ K^- \gamma$
26 ± 9	357	² BAI	04 BES	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
31 ± 7 ± 10	19	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
30 ⁺¹⁸ ₋₁₂ ± 10	5	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
74 ± 18 ± 24	80	² BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
67 ± 21 ± 24		² BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$

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

18⁺⁸₋₆ ± 7 ³ HUANG 03 BELL $B^+ \rightarrow (\phi\phi) K^+$ NODE=M026R7
NODE=M026R7

OCCUR=2

OCCUR=3

¹ ABLIKIM 17P reports $[\Gamma(\eta_c(1S) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (4.3 \pm 0.5^{+0.5}_{-1.2}) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² 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.

³ 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=M026R7;LINKAGE=A

NODE=M026R;LINKAGE=E

NODE=M026R7;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma(K\bar{K}\pi)$ **Γ_7/Γ_{27}**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.0243±0.0025 OUR FIT**0.044 $^{+0.012}_{-0.010}$ OUR AVERAGE**0.055 ±0.014 ±0.005 AUBERT,B 04B BABR $B^\pm \rightarrow K^\pm \eta_c$ 0.032 $^{+0.014}_{-0.010}$ ±0.009 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=M026R39
NODE=M026R39

NODE=M026R39;LINKAGE=BB

 $\Gamma(\phi\phi)/\Gamma(p\bar{p})$ **Γ_7/Γ_{41}**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

1.79±0.14±0.32 6.4k ¹ AAIJ 17BB LHCB $p\bar{p} \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$

¹ Using inputs from AAIJ 15AS and AAIJ 15BI and $\Gamma(b \rightarrow J/\psi(1S)\text{anything})/\Gamma_{\text{total}} = (1.16 \pm 0.10)\%$ and $\Gamma(J/\psi(1S) \rightarrow p\bar{p})/\Gamma_{\text{total}} = (2.120 \pm 0.029) \times 10^{-3}$ from PDG 16.

NODE=M026R52
NODE=M026R52

NODE=M026R52;LINKAGE=A

 $\Gamma(\phi 2(\pi^+\pi^-))/\Gamma_{\text{total}}$ **Γ_8/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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R26
NODE=M026R26

NODE=M026R26;LINKAGE=AB

 $\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ **Γ_9/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.02 90 ^{1,2} BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

² We are assuming $B(a_0(980) \rightarrow \eta\pi) > 0.5$.

NODE=M026R11
NODE=M026R11NODE=M026R11;LINKAGE=E
NODE=M026R11;LINKAGE=F **$\Gamma(a_2(1320)\pi)/\Gamma_{\text{total}}$** **$\Gamma_{10}/\Gamma$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.02 90 ¹ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R12
NODE=M026R12

NODE=M026R12;LINKAGE=E

 $\Gamma(K^*(892)\bar{K} + \text{c.c.})/\Gamma_{\text{total}}$ **Γ_{11}/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 $J/\psi \rightarrow \gamma K^\pm K^\mp \pi^0$

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_{12}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.011 90 ¹ BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$

¹ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R13
NODE=M026R13

NODE=M026R13;LINKAGE=E

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ **Γ_{13}/Γ**

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

2.9±0.5±0.6 1705 ¹ ABLIKIM 19AV BES3 $J/\psi \rightarrow \gamma\omega\omega$

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

<6.3 90 ² ABLIKIM 05L BES2 $J/\psi \rightarrow 2(\pi^+\pi^-\pi^0)\gamma$ <6.3 90 ² BISELLO 91 DM2 $J/\psi \rightarrow \gamma\omega\omega$ <3.1 90 ² BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ NODE=M026R10
NODE=M026R10

- ¹ ABLIKIM 19AV reports $[\Gamma(\eta_c(1S) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (4.90 \pm 0.17 \pm 0.77) \times 10^{-5}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.,
- ² 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=M026R10;LINKAGE=C

NODE=M026R10;LINKAGE=E

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.5 \times 10^{-4}$	90	¹ ABLIKIM	17P BES3	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 17 \times 10^{-4}$	90	² ABLIKIM	05L BES2	$J/\psi \rightarrow \pi^+ \pi^- \pi^0 K^+ K^- \gamma$

¹ Using $B(J/\psi \rightarrow \gamma\eta_c) = 0.017 \pm 0.004$.

² The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R22
NODE=M026R22

NODE=M026R22;LINKAGE=A
NODE=M026R22;LINKAGE=E

$\Gamma(f_2(1270)f_2(1270))/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 ± 0.25 OUR FIT				
$0.77^{+0.25}_{-0.30} \pm 0.17$	91.2 ± 19.8	¹ ABLIKIM	04M BES	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$

¹ ABLIKIM 04M reports $[\Gamma(\eta_c(1S) \rightarrow f_2(1270)f_2(1270))/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))] = (1.3 \pm 0.3^{+0.3}_{-0.4}) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R19
NODE=M026R19

NODE=M026R19;LINKAGE=AB

$\Gamma(f_0(980)\eta)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R41
NODE=M026R41

$\Gamma(f_0(1500)\eta)/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R42
NODE=M026R42

$\Gamma(f_0(2200)\eta)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \eta$

NODE=M026R43
NODE=M026R43

$\Gamma(a_0(980)\pi)/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R44
NODE=M026R44

$\Gamma(a_0(1320)\pi)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R45
NODE=M026R45

$\Gamma(a_0(1450)\pi)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R46
NODE=M026R46

$\Gamma(a_0(1950)\pi)/\Gamma_{\text{total}}$ Γ_{23}/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-independant partial wave analysis.

NODE=M026R00
NODE=M026R00

NODE=M026R00;LINKAGE=A

$\Gamma(K_0^*(1430)\bar{K})/\Gamma_{\text{total}}$ Γ_{24}/Γ

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 $\eta_c \rightarrow K^+ K^- \eta/\pi^0$

¹ From a model-independant partial wave analysis.

NODE=M026R47
NODE=M026R47

NODE=M026R47;LINKAGE=A

$\Gamma(K_2^*(1430)\bar{K})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	LEES	14E BABR	Dalitz anal. of $\eta_c \rightarrow K^+ K^- \pi^0$

NODE=M026R48
NODE=M026R48

$\Gamma(K_0^*(1950)\bar{K})/\Gamma_{\text{total}}$

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_{26}/Γ

NODE=M026R49
 NODE=M026R49

¹ From a Dalitz plot analysis using an isobar model.

NODE=M026R49;LINKAGE=A

 $\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.4 OUR FIT				
6.9 ± 0.4 OUR AVERAGE				
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	$h_c \rightarrow \gamma\eta_c$
6.3 ± 1.3 ± 0.6	55	^{3,4} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K^+K^-\pi^0$
7.9 ± 1.4 ± 0.7	107	^{5,6} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K_S^0 K^\mp\pi^\pm$
8.5 ± 1.8		⁷ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}\pi^\mp$
5.1 ± 2.1	0.6k	⁸ BAI	04 BES	$J/\psi \rightarrow \gamma K^\pm\pi^\mp K_S^0$
6.90 ± 1.42 ± 1.32	33	⁸ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^+K^-\pi^0$
5.43 ± 0.94 ± 0.94	68	⁸ BISELLO	91 DM2	$J/\psi \rightarrow \gamma K^\pm\pi^\mp K_S^0$
4.8 ± 1.7	95	^{8,9} BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$
16.1 $\begin{smallmatrix} +9.2 \\ -7.3 \end{smallmatrix}$		^{10,11} HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c\gamma$

 Γ_{27}/Γ

NODE=M026R4
 NODE=M026R4

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

< 10.7 90% CL ^{8,12} PARTRIDGE 80B CBAL $J/\psi \rightarrow \eta_c\gamma$

¹ ABLIKIM 19AP quotes $B(\eta_c \rightarrow K^+K^-\pi^0) = (1.15 \pm 0.12 \pm 0.10) \times 10^{-2}$ which we multiply by 6 to account for isospin symmetry.

² ABLIKIM 19AP quotes $B(\eta_c \rightarrow K_S^0 K^\pm\pi^\mp) = (2.60 \pm 0.21 \pm 0.20) \times 10^{-2}$ which we multiply by 3 to account for isospin symmetry.

³ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K^+K^-\pi^0) = (4.54 \pm 0.76 \pm 0.48) \times 10^{-6}$ which we multiply by 6 to account for isospin symmetry.

⁴ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (27.24 \pm 4.56 \pm 2.88) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ 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.

⁶ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (34.05 \pm 3.75 \pm 4.50) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁷ Determined from the ratio of $B(B^\pm \rightarrow K^\pm\eta_c) B(\eta_c \rightarrow K\bar{K}\pi) = (7.4 \pm 0.5 \pm 0.7) \times 10^{-5}$ reported in AUBERT, B 04B and $B(B^\pm \rightarrow K^\pm\eta_c) = (8.7 \pm 1.5) \times 10^{-3}$ reported in AUBERT 06E.

⁸ 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.

⁹ Average from $K^+K^-\pi^0$ and $K^\pm K_S^0\pi^\mp$ decay channels.

¹⁰ $K^\pm K_S^0\pi^\mp$ corrected to $K\bar{K}\pi$ by factor 3. KS, MR.

¹¹ Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

¹² $K^+K^-\pi^0$ corrected to $K\bar{K}\pi$ by factor 6. KS, MR

NODE=M026R4;LINKAGE=C

NODE=M026R4;LINKAGE=F

NODE=M026R4;LINKAGE=BK

NODE=M026R4;LINKAGE=CK

NODE=M026R4;LINKAGE=BL

NODE=M026R4;LINKAGE=CL

NODE=M026R4;LINKAGE=AB

NODE=M026R4;LINKAGE=E

NODE=M026R4;LINKAGE=D

NODE=M026R4;LINKAGE=01

NODE=M026R4;LINKAGE=A

NODE=M026R4;LINKAGE=02

 $\Gamma(\phi K^+K^-)/\Gamma(K\bar{K}\pi)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.052$\begin{smallmatrix} +0.016 \\ -0.014 \end{smallmatrix}$ ± 0.014	7	¹ HUANG	03 BELL	$B^\pm \rightarrow K^\pm\phi\phi$

 Γ_6/Γ_{27}

NODE=M026R02
 NODE=M026R02

¹ Using $B(B^+ \rightarrow \eta_c K^+) = (1.25 \pm 0.12 \pm 0.10) \times 10^{-3}$ from FANG 03 and $B(\eta_c \rightarrow K\bar{K}\pi) = (5.5 \pm 1.7) \times 10^{-2}$.

NODE=M026R02;LINKAGE=BB

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

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

1.36±0.15 OUR FIT**1.0 ±0.5 ±0.2**7 1,2 ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta K^+ K^-$

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

<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 $[\Gamma(\eta_c(1S) \rightarrow K\bar{K}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] \times [B(h_c(1P) \rightarrow \gamma \eta_c(1S))] = (4.22 \pm 2.02 \pm 0.64) \times 10^{-6}$ which we divide by our best values $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$, $B(h_c(1P) \rightarrow \gamma \eta_c(1S)) = (51 \pm 6) \times 10^{-2}$. 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

 $\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi)$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT

0.186±0.018 OUR 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

NODE=M026R40;LINKAGE=LE

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

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

1.7±0.4±0.1

• • • 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 $[\Gamma(\eta_c(1S) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.22 \pm 1.47 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² 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

NODE=M026R6;LINKAGE=AB

NODE=M026R6;LINKAGE=E

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

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

4.4±1.2±0.439 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma \eta 2(\pi^+\pi^-)$ ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \eta 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (19.17 \pm 3.77 \pm 3.72) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.NODE=M026R05
NODE=M026R05

NODE=M026R05;LINKAGE=AB

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

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

6.9± 1.0 OUR FIT**11.2± 1.9 OUR AVERAGE**9.7± 2.2±0.9 38 ¹ ABLIKIM 12N BES3 $\psi(2S) \rightarrow \pi^0 \gamma K^+ K^- \pi^+ \pi^-$ 12 ± 4 0.4k ² BAI 04 BES $J/\psi \rightarrow \gamma K^+ K^- \pi^+ \pi^-$ 21 ± 7 110 ² BALTRUSAIT..86 MRK3 $J/\psi \rightarrow \eta_c \gamma$ 14 ⁺²²₋₉ ³ HIMEL 80B MRK2 $\psi(2S) \rightarrow \eta_c \gamma$ ¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (4.16 \pm 0.76 \pm 0.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.² 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.³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.NODE=M026R5
NODE=M026R5

NODE=M026R5;LINKAGE=AB

NODE=M026R5;LINKAGE=E

NODE=M026R5;LINKAGE=A

$\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K\bar{K}\pi)$ Γ_{32}/Γ_{27}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.477±0.017±0.070	11k	¹ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M026R01
 NODE=M026R01

¹ We have multiplied the value of $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma(K_S^0K^\pm\pi^\mp)$ 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;LINKAGE=DE

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.6±1.4±0.5	43	^{1,2} ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K_S^0K^\mp\pi^\mp 2\pi^\pm$

NODE=M026R06
 NODE=M026R06

¹ ABLIKIM 12N quotes $B(\psi(2S) \rightarrow \pi^0 h_c) \cdot B(h_c \rightarrow \gamma\eta_c) \cdot B(\eta_c \rightarrow K_S^0K^-\pi^-2\pi^+)$ = $(12.01 \pm 2.22 \pm 2.04) \times 10^{-6}$ which we multiply by 2 to take c.c. into account.

NODE=M026R06;LINKAGE=AA

² ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^0K^-\pi^+\pi^-\pi^++c.c.)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (24.02 \pm 4.44 \pm 4.08) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R06;LINKAGE=AB

 $\Gamma(K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.5±2.4 OUR AVERAGE				

NODE=M026R23
 NODE=M026R23

8 ±4 ±1	10	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma K^+K^-2(\pi^+\pi^-)$
7.2±2.4±1.5	100	² ABLIKIM	06A BES2	$J/\psi \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (3.60 \pm 1.71 \pm 0.64) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AL

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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R23;LINKAGE=AB

 $\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.46± 0.30 OUR FIT				

NODE=M026R20
 NODE=M026R20

2.2 ± 0.9 ± 0.2	7	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 2(K^+K^-)$

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

1.4 $\pm$ 0.5 $\pm$ 0.6	14.5 $^{+4.6}_{-3.0}$	² HUANG	03 BELL	$B^+ \rightarrow 2(K^+K^-)K^+$
21 ±10 ±6		³ ALBRECHT	94H ARG	$\gamma\gamma \rightarrow K^+K^-K^+K^-$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(K^+K^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.94 \pm 0.37 \pm 0.14) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R20;LINKAGE=AB

² 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=M026R20;LINKAGE=BB

³ 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 $B(\eta_c \rightarrow 2\pi^+2\pi^-)$.

NODE=M026R20;LINKAGE=AL

 $\Gamma(2(K^+K^-))/\Gamma(K\bar{K}\pi)$ Γ_{35}/Γ_{27}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.020±0.004 OUR FIT				

NODE=M026R38
 NODE=M026R38

0.024±0.007 OUR AVERAGE

0.023±0.007±0.006		AUBERT,B	04B BABR	$B^\pm \rightarrow K^\pm\eta_c$
0.026 $^{+0.009}_{-0.007}$ ±0.007	15	¹ HUANG	03 BELL	$B^\pm \rightarrow K^\pm(2K^+2K^-)$

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=M026R38;LINKAGE=BB

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5 \times 10^{-4}$	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 $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 3.4 \times 10^{-3}$.				

NODE=M026R51
 NODE=M026R51

NODE=M026R51;LINKAGE=A

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.7 \pm 0.9 \pm 0.4$	118	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma\pi^+\pi^-2\pi^0$
¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (20.31 \pm 2.20 \pm 3.33) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M026R07
 NODE=M026R07

NODE=M026R07;LINKAGE=AB

 $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97 ± 0.12 OUR FIT				
1.35 ± 0.21 OUR AVERAGE				
$1.74 \pm 0.32 \pm 0.15$	100	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-)$
1.0 ± 0.5	542 ± 75	² BAI	04 BES	$J/\psi \rightarrow \gamma 2(\pi^+\pi^-)$
$1.05 \pm 0.17 \pm 0.34$	137	² BISELLO	91 DM2	$J/\psi \rightarrow \gamma 2\pi^+ 2\pi^-$
1.3 ± 0.6	25	² BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c\gamma$
$2.0^{+1.5}_{-1.0}$		³ HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c\gamma$

NODE=M026R1
 NODE=M026R1

NODE=M026R1;LINKAGE=AB

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (7.51 \pm 0.85 \pm 1.11) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² 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.

³ Estimated using $B(\psi(2S) \rightarrow \gamma\eta_c(1S)) = 0.0028 \pm 0.0006$.

NODE=M026R1;LINKAGE=E

NODE=M026R1;LINKAGE=A

 $\Gamma(2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
16.1 ± 2.0 OUR AVERAGE				
$15.3 \pm 1.8 \pm 1.8$	333	ABLIKIM	19AP BES3	$h_c \rightarrow \gamma\eta_c$
$17.4 \pm 2.9 \pm 1.5$	175	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 2(\pi^+\pi^-\pi^0)$

NODE=M026R08
 NODE=M026R08

NODE=M026R08;LINKAGE=AB

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 2(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (75.13 \pm 7.42 \pm 9.99) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
18 ± 4 OUR AVERAGE				
$20 \pm 5 \pm 2$	51	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0\gamma 3(\pi^+\pi^-)$
$15.4 \pm 3.4 \pm 3.3$	479	² ABLIKIM	06A BES2	$J/\psi \rightarrow 3(\pi^+\pi^-)\gamma$

NODE=M026R24
 NODE=M026R24

NODE=M026R24;LINKAGE=AL

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow 3(\pi^+\pi^-))/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (8.82 \pm 1.57 \pm 1.59) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 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 $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R24;LINKAGE=AB

$\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{41}/Γ NODE=M026R2
NODE=M026R2**14.5 ± 1.4 OUR FIT****12.7 ± 2.0 OUR AVERAGE**

12.0 ± 2.6 ± 1.5	34	ABLIKIM	19APBES3	$h_c \rightarrow \gamma \eta_c$
15 ± 5 ± 1	15	1 ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p}$
15 ± 6	213 ± 33	2 BAI	04 BES	$J/\psi \rightarrow \gamma p \bar{p}$
10 ± 3 ± 4	18	2 BISELLO	91 DM2	$J/\psi \rightarrow \gamma p \bar{p}$
11 ± 6	23	2 BALTRUSAIT..86	MRK3	$J/\psi \rightarrow \eta_c \gamma$
29 +29 -15		3 HIMEL	80B MRK2	$\psi(2S) \rightarrow \eta_c \gamma$

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

13.2 +1.8+0.9 -2.1-1.0	195	4 WU	06 BELL	$B^+ \rightarrow p \bar{p} K^+$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p})/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (0.65 \pm 0.19 \pm 0.10) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² 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.

³ Estimated using $B(\psi(2S) \rightarrow \gamma \eta_c(1S)) = 0.0028 \pm 0.0006$.

⁴ 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 $B(B^+ \rightarrow \eta_c K^+) = (1.08 \pm 0.08) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R2;LINKAGE=AB

NODE=M026R2;LINKAGE=E

NODE=M026R2;LINKAGE=A

NODE=M026R2;LINKAGE=WU

 $\Gamma(p\bar{p})/\Gamma(K\bar{K}\pi)$

VALUE EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{41}/Γ_{27} NODE=M026R03
NODE=M026R03**0.0199 ± 0.0019 OUR FIT**

0.021 ± 0.002 +0.004 -0.006	195	1 WU	06 BELL	$B^\pm \rightarrow K^\pm p \bar{p}$

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=M026R03;LINKAGE=BB

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

TECN

COMMENT

 $\Gamma_{41}/\Gamma \times \Gamma_7/\Gamma$ NODE=M026R33
NODE=M026R33**0.26 ± 0.04 OUR FIT**

4.0 +3.5 -3.2		BAGLIN	89 SPEC	$\bar{p} p \rightarrow K^+ K^- K^+ K^-$

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{42}/Γ NODE=M026R09
NODE=M026R09

0.36 ± 0.13 ± 0.03	14	1 ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma p \bar{p} \pi^0$

¹ ABLIKIM 12N reports $[\Gamma(\eta_c(1S) \rightarrow p \bar{p} \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}] = (1.53 \pm 0.49 \pm 0.23) \times 10^{-6}$ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}} = (4.3 \pm 0.4) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R09;LINKAGE=AB

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL% EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{43}/Γ NODE=M026R18
NODE=M026R18**10.7 ± 2.4 OUR FIT****11.8 ± 2.3 ± 2.5**

1 ABLIKIM 12B BES3

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

8.8 +2.4 -2.3 ± 0.6	20	2 WU	06 BELL	$B^+ \rightarrow \Lambda \bar{\Lambda} K^+$
<20	90	3 BISELLO	91 DM2	$e^+ e^- \rightarrow \gamma \Lambda \bar{\Lambda}$

¹ ABLIKIM 12B reports $[\Gamma(\eta_c(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (0.198 \pm 0.021 \pm 0.032) \times 10^{-4}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R18;LINKAGE=AB

² WU 06 reports $[\Gamma(\eta_c(1S) \rightarrow \Lambda \bar{\Lambda})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \eta_c K^+)] = (0.95^{+0.25+0.08}_{-0.22-0.11}) \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \eta_c K^+) = (1.08 \pm 0.08) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R18;LINKAGE=WU

³ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R18;LINKAGE=E

$\Gamma(\Lambda\bar{\Lambda})/\Gamma(p\bar{p})$ Γ_{43}/Γ_{41}

VALUE	DOCUMENT ID	TECN	COMMENT
0.73±0.16 OUR FIT			
0.67^{+0.19}_{-0.16} ±0.12	¹ WU	06	BELL $B^+ \rightarrow p\bar{p}K^+, \Lambda\bar{\Lambda}K^+$

¹ Not independent from other $\eta_c \rightarrow \Lambda\bar{\Lambda}, p\bar{p}$ branching ratios reported by WU 06.

NODE=M026R27
NODE=M026R27

NODE=M026R27;LINKAGE=WU

 $\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ±0.4 OUR AVERAGE [(2.6 ± 0.4) × 10 ⁻³ OUR 2020 AVERAGE]				
2.52^{+0.34}_{-0.32} ±0.18	157	¹ LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$

¹ LU 19 reports (2.83^{+0.36}_{-0.34} ± 0.35) × 10⁻³ from a measurement of [$\Gamma(\eta_c(1S) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \eta_c K^+$)] assuming B($B^+ \rightarrow \eta_c K^+$) = (9.6 ± 1.1) × 10⁻⁴, which we rescale to our best value B($B^+ \rightarrow \eta_c K^+$) = (1.08 ± 0.08) × 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
NODE=M026R53

NEW

NODE=M026R53;LINKAGE=A

 $\Gamma(\bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.3±0.2	43	¹ LU	19	BELL $B^+ \rightarrow \bar{p}\Lambda K^+ K^+$

¹ LU 19 reports (3.48 ± 1.48 ± 0.46) × 10⁻³ from a measurement of [$\Gamma(\eta_c(1S) \rightarrow \bar{\Lambda}(1520)\Lambda + \text{c.c.})/\Gamma_{\text{total}}$] × [B($B^+ \rightarrow \eta_c K^+$)] assuming B($B^+ \rightarrow \eta_c K^+$) = (9.6 ± 1.1) × 10⁻⁴, which we rescale to our best value B($B^+ \rightarrow \eta_c K^+$) = (1.08 ± 0.08) × 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
NODE=M026R54

NODE=M026R54;LINKAGE=A

 $\Gamma(\Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.1±0.3±0.5	112	¹ ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma p\bar{p}\pi^0\pi^0$

¹ ABLIKIM 13C reports [$\Gamma(\eta_c(1S) \rightarrow \Sigma^+\bar{\Sigma}^-)/\Gamma_{\text{total}}$] × [B($J/\psi(1S) \rightarrow \gamma\eta_c(1S)$)] = (3.60 ± 0.48 ± 0.31) × 10⁻⁵ which we divide by our best value B($J/\psi(1S) \rightarrow \gamma\eta_c(1S)$) = (1.7 ± 0.4) × 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
NODE=M026R28

NODE=M026R28;LINKAGE=AB

 $\Gamma(\Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.90±0.18±0.19	78	¹ ABLIKIM	13C	BES3 $J/\psi \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 13C reports [$\Gamma(\eta_c(1S) \rightarrow \Xi^-\bar{\Xi}^+)/\Gamma_{\text{total}}$] × [B($J/\psi(1S) \rightarrow \gamma\eta_c(1S)$)] = (1.51 ± 0.27 ± 0.14) × 10⁻⁵ which we divide by our best value B($J/\psi(1S) \rightarrow \gamma\eta_c(1S)$) = (1.7 ± 0.4) × 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
NODE=M026R29

NODE=M026R29;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\rho\bar{p})/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.3±1.7±0.5		19	¹ ABLIKIM	12N	BES3 $\psi(2S) \rightarrow \pi^0\gamma p\bar{p}\pi^+\pi^-$

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

<12	90	HIMEL	80B	MRK2	$\psi(2S) \rightarrow \eta_c\gamma$

¹ ABLIKIM 12N reports [$\Gamma(\eta_c(1S) \rightarrow \pi^+\pi^-\rho\bar{p})/\Gamma_{\text{total}}$] × [$\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$] × [$\Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$] = (2.30 ± 0.65 ± 0.36) × 10⁻⁶ which we divide by our best value $\Gamma(h_c(1P) \rightarrow \gamma\eta_c(1S))/\Gamma_{\text{total}}$ × [$\Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$] = (4.3 ± 0.4) × 10⁻⁴. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M026R3
NODE=M026R3

NODE=M026R3;LINKAGE=AB

RADIATIVE DECAYS

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.58±0.11 OUR FIT					

1.9^{+0.7}_{-0.6} OUR AVERAGE

2.7 ±0.8 ±0.6			¹ ABLIKIM	13I	BES3
1.4 ^{+0.7} _{-0.5} ±0.3	1.2 ^{+2.8} _{-1.1}		² ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M026310

NODE=M026R31
NODE=M026R31

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

2.0 ^{+0.9} _{-0.7} ± 0.1	13	³ WICHT	08	BELL	$B^\pm \rightarrow K^\pm \gamma \gamma$
2.80 ^{+0.67} _{-0.58} ± 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 ± 4		⁴ BAGLIN	87B	SPEC	$\bar{p}p \rightarrow \gamma \gamma$
< 18	90	⁶ BLOOM	83	CBAL	$J/\psi \rightarrow \eta_c \gamma$

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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ADAMS 08 reports $[\Gamma(\eta_c(1S) \rightarrow \gamma \gamma)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma \eta_c(1S))] = (2.4^{+1.1}_{-0.8} \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = (1.7 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ WICHT 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 $B(B^+ \rightarrow \eta_c K^+) = (1.08 \pm 0.08) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Not independent from the values of the total and two-photon width quoted by the same experiment.

⁵ The quoted branching ratios use $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

⁶ Using $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 0.0127 \pm 0.0036$.

NODE=M026R31;LINKAGE=AL

NODE=M026R31;LINKAGE=AD

NODE=M026R31;LINKAGE=WI

NODE=M026R31;LINKAGE=AB

NODE=M026R31;LINKAGE=E

NODE=M026R31;LINKAGE=C

$\Gamma(\gamma \gamma)/\Gamma(K \bar{K} \pi)$

Γ_{49}/Γ_{27}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.17 ± 0.23 OUR FIT				
3.2 ^{+1.3} _{-1.0} ^{+0.8} _{-0.6}	13	¹ WICHT	08	BELL $B^\pm \rightarrow K^\pm \gamma \gamma$

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=M026R04
NODE=M026R04

NODE=M026R04;LINKAGE=BB

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

$\Gamma_{41}/\Gamma \times \Gamma_{49}/\Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
0.230 ± 0.022 OUR FIT				
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	$\bar{p}p \rightarrow \gamma \gamma$

NODE=M026R32
NODE=M026R32

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

NODE=M026320

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

Γ_{50}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 11	90	¹ ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma \pi^+ \pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 70	90	² ABLIKIM	06B	BES2 $J/\psi \rightarrow \pi^+ \pi^- \gamma$

¹ ABLIKIM 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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

² ABLIKIM 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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R34;LINKAGE=AL

NODE=M026R34;LINKAGE=AB

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

Γ_{51}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 4	90	¹ ABLIKIM	11G	BES3 $J/\psi \rightarrow \gamma \pi^0 \pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 40	90	² ABLIKIM	06B	BES2 $J/\psi \rightarrow \pi^0 \pi^0 \gamma$

¹ ABLIKIM 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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

² ABLIKIM 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 $B(J/\psi(1S) \rightarrow \gamma \eta_c(1S)) = 1.7 \times 10^{-2}$.

NODE=M026R35
NODE=M026R35

NODE=M026R35;LINKAGE=AL

NODE=M026R35;LINKAGE=AB

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<60	90	¹ ABLIKIM	06B BES2	$J/\psi \rightarrow K^+K^-\gamma$
¹ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K^+K^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$ < 0.96×10^{-5} which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<31	90	¹ ABLIKIM	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 UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
< 5.6	90	³ UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
¹ ABLIKIM 06B reports $[\Gamma(\eta_c(1S) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \gamma\eta_c(1S))]$ < 0.53×10^{-5} which we divide by our best value $B(J/\psi(1S) \rightarrow \gamma\eta_c(1S)) = 1.7 \times 10^{-2}$.				
² Taking into account interference with the non-resonant continuum.				
³ Neglecting interference with the non-resonant continuum.				

$\eta_c(1S)$ REFERENCES

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.)
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE 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.)
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)
AAIJ	15AS	JHEP 1510 053	R. Aaij <i>et al.</i>	(LHCb 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>	(BELLE 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.)
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DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
LEES	10	PR D81 052010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MITCHELL	09	PRL 102 011801	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
ADAMS	08	PRL 101 101801	G.S. Adams <i>et al.</i>	(CLEO Collab.)
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)
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ABLIKIM	06A	PL B633 19	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06B	EPJ C45 337	M. Ablikim <i>et al.</i>	(BES Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
WU	06	PRL 97 162003	C.-H. Wu <i>et al.</i>	(BELLE Collab.)
ABLIKIM	05L	PR D72 072005	M. Ablikim <i>et al.</i>	(BES Collab.)
KUO	05	PL B621 41	C.C. Kuo <i>et al.</i>	(BELLE Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ABLIKIM	04M	PR D70 112008	M. Ablikim <i>et al.</i>	(BES Collab.)
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04B	PR D70 011101	B. Aubert <i>et al.</i>	(BABAR Collab.)
BAI	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABDALLAH	03J	EPJ C31 481	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
AMBROGIANI	03	PL B566 45	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
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FANG	03	PRL 90 071801	F. Fang <i>et al.</i>	(BELLE Collab.)
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
BAI	00F	PR D62 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRANDENB...	00B	PRL 85 3095	G. Brandenburg <i>et al.</i>	(CLEO Collab.)
ACCIARRI	99T	PL B461 155	M. Acciarri <i>et al.</i>	(L3 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
SHIRAI	98	PL B424 405	M. Shirai <i>et al.</i>	(AMY Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
ALBRECHT	94H	PL B338 390	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ADRIANI	93N	PL B318 575	O. Adriani <i>et al.</i>	(L3 Collab.)
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)
BAI	90B	PRL 65 1309	Z. Bai <i>et al.</i>	(Mark III Collab.)
CHEN	90B	PL B243 169	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
BAGLIN	89	PL B231 557	C. Baglin, S. Baird, G. Bassompierre	(R704 Collab.)
BEHREND	89	ZPHY C42 367	H.J. Behrend <i>et al.</i>	(CELLO Collab.)
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BAGLIN	87B	PL B187 191	C. Baglin <i>et al.</i>	(R704 Collab.)
BALTRUSAIT...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BERGER	86	PL 167B 120	C. Berger <i>et al.</i>	(PLUTO Collab.)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
ALTHOFF	85B	ZPHY C29 189	M. Althoff <i>et al.</i>	(TASSO Collab.)
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)
BLOOM	83	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)
HIMEL	80B	PRL 45 1146	T.M. Himel <i>et al.</i>	(SLAC, LBL, UCB)
PARTRIDGE	80B	PRL 45 1150	R. Partridge <i>et al.</i>	(CIT, HARV, PRIN+)

 Γ_{52}/Γ

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 NODE=M026R36

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 Γ_{53}/Γ

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OCCUR=2

NODE=M026R37;LINKAGE=AB

NODE=M026R37;LINKAGE=U1
 NODE=M026R37;LINKAGE=U2

NODE=M026

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$J/\psi(1S)$

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

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 15BI	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

NEW

VALUE (keV)	EVTs	DOCUMENT ID	TECN	COMMENT
92.6 ± 1.7 OUR AVERAGE				
Error includes scale factor of 1.1. [92.9 ± 2.8 keV OUR 2020 AVERAGE Scale factor = 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 $\mathcal{T}$ 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 $\gamma \rightarrow \text{hadrons}$	(13.50 ± 0.30) %	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

Γ_8	$\rho\pi$	(1.69 $\pm$ 0.15) %	S=2.4	NODE=M070;CLUMP=A
Γ_9	$\rho^0\pi^0$	(5.6 $\pm$ 0.7) $\times 10^{-3}$		DESIG=20
Γ_{10}	$\rho(770)^\mp K^\pm K_S^0$	(1.9 $\pm$ 0.4) $\times 10^{-3}$		DESIG=21
Γ_{11}	$\rho(1450)\pi$			DESIG=342
Γ_{12}	$\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.3 $\pm$ 0.7) $\times 10^{-3}$		DESIG=310
Γ_{13}	$\rho(1450)^\pm \pi^\mp \rightarrow K_S^0 K^\pm \pi^\mp$	(3.5 $\pm$ 0.6) $\times 10^{-4}$		DESIG=328
Γ_{14}	$\rho(1450)^0 \pi^0 \rightarrow K^+ K^- \pi^0$	(2.7 $\pm$ 0.6) $\times 10^{-4}$		DESIG=329
Γ_{15}	$\rho(1450)\eta'(958) \rightarrow \pi^+\pi^-\eta'(958)$	(3.3 $\pm$ 0.7) $\times 10^{-6}$		DESIG=312
Γ_{16}	$\rho(1700)\pi$			DESIG=345
Γ_{17}	$\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0$	(1.7 $\pm$ 1.1) $\times 10^{-4}$		DESIG=325
Γ_{18}	$\rho(2150)\pi$			DESIG=313
Γ_{19}	$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	(8 $\pm$ 40) $\times 10^{-6}$		DESIG=326
Γ_{20}	$\rho_3(1690)\pi \rightarrow \pi^+\pi^-\pi^0$			DESIG=314
Γ_{21}	$a_2(1320)\rho$	(1.09 $\pm$ 0.22) %		DESIG=316
Γ_{22}	$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 $\pm$ 3.4) $\times 10^{-3}$		DESIG=43
Γ_{23}	$\omega\pi^+\pi^-\pi^0$	(4.0 $\pm$ 0.7) $\times 10^{-3}$		DESIG=26
Γ_{24}	$\omega\pi^+\pi^-$	(7.2 $\pm$ 1.0) $\times 10^{-3}$		DESIG=211
Γ_{25}	$\omega f_2(1270)$	(4.3 $\pm$ 0.6) $\times 10^{-3}$		DESIG=24
Γ_{26}	$K^*(892)^0 \bar{K}^*(892)^0$	(2.3 $\pm$ 0.6) $\times 10^{-4}$		DESIG=28
Γ_{27}	$K^*(892)^\pm K^*(892)^\mp$	(1.00 $\pm$ 0.22 / 0.40) $\times 10^{-3}$		DESIG=46
Γ_{28}	$K^*(892)^\pm K^*(700)^\mp$	(1.1 $\pm$ 1.0 / 0.6) $\times 10^{-3}$		DESIG=256
Γ_{29}	$K_S^0 \pi^- K^*(892)^+ + \text{c.c.}$	(2.0 $\pm$ 0.5) $\times 10^{-3}$		DESIG=257
Γ_{30}	$K_S^0 \pi^- K^*(892)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-$	(6.7 $\pm$ 2.2) $\times 10^{-4}$		DESIG=299
Γ_{31}	$K_S^0 K^*(892)^0 \rightarrow \gamma K_S^0 K_S^0$	(6.3 $\pm$ 0.6 / 0.5) $\times 10^{-6}$		DESIG=300
Γ_{32}	$K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(2.69 $\pm$ 0.25 / 0.19) $\times 10^{-4}$		DESIG=376
Γ_{33}	$K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(1.10 $\pm$ 0.60 / 0.14) $\times 10^{-5}$		DESIG=381
Γ_{34}	$K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$	(6.2 $\pm$ 2.9 / 1.6) $\times 10^{-6}$		DESIG=382
Γ_{35}	$\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 $\pm$ 0.26) $\times 10^{-3}$		DESIG=383
Γ_{36}	$\eta' K^{*\pm} K^\mp$	(1.48 $\pm$ 0.13) $\times 10^{-3}$		DESIG=252
Γ_{37}	$\eta' K^{*0} \bar{K}^0 + \text{c.c.}$	(1.66 $\pm$ 0.21) $\times 10^{-3}$		DESIG=355
Γ_{38}	$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.}$	(2.16 $\pm$ 0.31) $\times 10^{-4}$		DESIG=357
Γ_{39}	$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	(1.51 $\pm$ 0.23) $\times 10^{-4}$		DESIG=353
Γ_{40}	$K^*(1410) \bar{K} + \text{c.c.}$			DESIG=354
Γ_{41}	$K^*(1410) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0$	(7 $\pm$ 4) $\times 10^{-5}$		DESIG=317
Γ_{42}	$K^*(1410) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	(8 $\pm$ 6) $\times 10^{-5}$		DESIG=330
Γ_{43}	$K_2^*(1430) \bar{K} + \text{c.c.}$			DESIG=318
Γ_{44}	$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0$	(1.0 $\pm$ 0.5) $\times 10^{-4}$		DESIG=319
Γ_{45}	$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	(4.0 $\pm$ 1.0) $\times 10^{-4}$		DESIG=321
Γ_{46}	$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	(4.67 $\pm$ 0.29) $\times 10^{-3}$		DESIG=320
Γ_{47}	$K^*(892)^+ K_2^*(1430)^- + \text{c.c.}$	(3.4 $\pm$ 2.9) $\times 10^{-3}$		DESIG=48
Γ_{48}	$K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	(4 $\pm$ 4) $\times 10^{-4}$		DESIG=303
Γ_{49}	$K^*(892)^0 \bar{K}_2^*(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(6.9 $\pm$ 0.9) $\times 10^{-4}$		DESIG=304
Γ_{50}	$\omega K^*(892) \bar{K} + \text{c.c.}$	(6.1 $\pm$ 0.9) $\times 10^{-3}$		DESIG=235
Γ_{51}	$\bar{K} K^*(892) + \text{c.c.}$			DESIG=102
Γ_{52}	$\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp$	(5.0 $\pm$ 0.5) $\times 10^{-3}$		DESIG=331
				DESIG=332

Γ ₅₃	$K^+ K^*(892)^- + \text{c.c.}$		$(6.0 \pm_{-1.0}^{+0.8}) \times 10^{-3}$	S=2.9	DESIG=121
Γ ₅₄	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0$		$(2.69 \pm_{-0.20}^{+0.13}) \times 10^{-3}$		DESIG=231
Γ ₅₅	$K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$		$(3.0 \pm 0.4) \times 10^{-3}$		DESIG=232
Γ ₅₆	$K^0 \bar{K}^*(892)^0 + \text{c.c.}$		$(4.2 \pm 0.4) \times 10^{-3}$		DESIG=122
Γ ₅₇	$K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}$		$(3.2 \pm 0.4) \times 10^{-3}$		DESIG=233
Γ ₅₈	$K_1(1400)^\pm K^\mp$		$(3.8 \pm 1.4) \times 10^{-3}$		DESIG=132
Γ ₅₉	$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$		$(7.7 \pm 1.6) \times 10^{-3}$		DESIG=214
Γ ₆₀	$K^*(892)^\pm K^\mp \pi^0$		$(4.1 \pm 1.3) \times 10^{-3}$		DESIG=343
Γ ₆₁	$K^*(892)^0 K_S^0 \pi^0$		$(7 \pm 4) \times 10^{-4}$		DESIG=344
Γ ₆₂	$\omega \pi^0 \pi^0$		$(3.4 \pm 0.8) \times 10^{-3}$		DESIG=140
Γ ₆₃	$\omega \pi^0 \eta$		$(3.4 \pm 1.7) \times 10^{-4}$		DESIG=360
Γ ₆₄	$b_1(1235)^\pm \pi^\mp$	[b]	$(3.0 \pm 0.5) \times 10^{-3}$		DESIG=49
Γ ₆₅	$\omega K^\pm K_S^0 \pi^\mp$	[b]	$(3.4 \pm 0.5) \times 10^{-3}$		DESIG=101
Γ ₆₆	$b_1(1235)^0 \pi^0$		$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=160
Γ ₆₇	$\eta K^\pm K_S^0 \pi^\mp$	[b]	$(2.2 \pm 0.4) \times 10^{-3}$		DESIG=230
Γ ₆₈	$\phi K^*(892) \bar{K} + \text{c.c.}$		$(2.18 \pm 0.23) \times 10^{-3}$		DESIG=104
Γ ₆₉	$\omega K \bar{K}$		$(1.9 \pm 0.4) \times 10^{-3}$		DESIG=27
Γ ₇₀	$\omega f_0(1710) \rightarrow \omega K \bar{K}$		$(4.8 \pm 1.1) \times 10^{-4}$		DESIG=130
Γ ₇₁	$\phi 2(\pi^+ \pi^-)$		$(1.60 \pm 0.32) \times 10^{-3}$		DESIG=35
Γ ₇₂	$\Delta(1232)^{++} \bar{p} \pi^-$		$(1.6 \pm 0.5) \times 10^{-3}$		DESIG=70
Γ ₇₃	$\omega \eta$		$(1.74 \pm 0.20) \times 10^{-3}$	S=1.6	DESIG=30
Γ ₇₄	$\omega \eta' \pi^+ \pi^-$		$(1.12 \pm 0.13) \times 10^{-3}$		DESIG=385
Γ ₇₅	$\phi K \bar{K}$		$(1.77 \pm 0.16) \times 10^{-3}$	S=1.3	DESIG=36
Γ ₇₆	$\phi K_S^0 K_S^0$		$(5.9 \pm 1.5) \times 10^{-4}$		DESIG=305
Γ ₇₇	$\phi f_0(1710) \rightarrow \phi K \bar{K}$		$(3.6 \pm 0.6) \times 10^{-4}$		DESIG=129
Γ ₇₈	$\phi K^+ K^-$		$(8.3 \pm 1.1) \times 10^{-4}$		DESIG=295
Γ ₇₉	$\phi f_2(1270)$		$(3.2 \pm 0.6) \times 10^{-4}$		DESIG=39
Γ ₈₀	$\Delta(1232)^{++} \bar{\Delta}(1232)^{--}$		$(1.10 \pm 0.29) \times 10^{-3}$		DESIG=66
Γ ₈₁	$\Sigma(1385)^- \bar{\Sigma}(1385)^+ (\text{or c.c.})$	[b]	$(1.16 \pm 0.05) \times 10^{-3}$		DESIG=67
Γ ₈₂	$\Sigma(1385)^0 \bar{\Sigma}(1385)^0$		$(1.07 \pm 0.08) \times 10^{-3}$		DESIG=309
Γ ₈₃	$K^+ K^- f_2'(1525)$		$(1.06 \pm 0.35) \times 10^{-3}$		DESIG=308
Γ ₈₄	$\phi f_2'(1525)$		$(8 \pm 4) \times 10^{-4}$	S=2.7	DESIG=40
Γ ₈₅	$\phi \pi^+ \pi^-$		$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	DESIG=34
Γ ₈₆	$\phi \pi^0 \pi^0$		$(5.0 \pm 1.0) \times 10^{-4}$		DESIG=76
Γ ₈₇	$\phi K^\pm K_S^0 \pi^\mp$	[b]	$(7.2 \pm 0.8) \times 10^{-4}$		DESIG=103
Γ ₈₈	$\omega f_1(1420)$		$(6.8 \pm 2.4) \times 10^{-4}$		DESIG=105
Γ ₈₉	$\phi \eta$		$(7.4 \pm 0.8) \times 10^{-4}$	S=1.5	DESIG=37
Γ ₉₀	$\Xi^0 \Xi^0$		$(1.17 \pm 0.04) \times 10^{-3}$		DESIG=248
Γ ₉₁	$\Xi(1530)^- \Xi^+ + \text{c.c.}$		$(3.18 \pm 0.08) \times 10^{-4}$		DESIG=107
Γ ₉₂	$p K^- \bar{\Sigma}(1385)^0$		$(5.1 \pm 3.2) \times 10^{-4}$		DESIG=74
Γ ₉₃	$\omega \pi^0$		$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	DESIG=32
Γ ₉₄	$\omega \pi^0 \rightarrow \pi^+ \pi^- \pi^0$		$(1.7 \pm 0.8) \times 10^{-5}$		DESIG=327
Γ ₉₅	$\phi \eta'(958)$		$(4.6 \pm 0.5) \times 10^{-4}$	S=2.2	DESIG=38
Γ ₉₆	$\phi f_0(980)$		$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	DESIG=41
Γ ₉₇	$\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$		$(2.60 \pm 0.34) \times 10^{-4}$		DESIG=236
Γ ₉₈	$\phi f_0(980) \rightarrow \phi \pi^0 \pi^0$		$(1.8 \pm 0.5) \times 10^{-4}$		DESIG=237
Γ ₉₉	$\phi \eta \eta'$		$(2.32 \pm 0.17) \times 10^{-4}$		DESIG=387
Γ ₁₀₀	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$		$(4.5 \pm 1.0) \times 10^{-6}$		DESIG=278
Γ ₁₀₁	$\phi \pi^0 f_0(980) \rightarrow \phi \pi^0 p^0 \pi^0$		$(1.7 \pm 0.6) \times 10^{-6}$		DESIG=279
Γ ₁₀₂	$\eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-$		$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=229
Γ ₁₀₃	$\phi a_0(980)^0 \rightarrow \phi \eta \pi^0$		$(4.4 \pm 1.4) \times 10^{-6}$		DESIG=258
Γ ₁₀₄	$\Xi(1530)^0 \Xi^0$		$(3.2 \pm 1.4) \times 10^{-4}$		DESIG=108
Γ ₁₀₅	$\Sigma(1385)^- \bar{\Sigma}^+ (\text{or c.c.})$	[b]	$(3.1 \pm 0.5) \times 10^{-4}$		DESIG=68
Γ ₁₀₆	$\phi f_1(1285)$		$(2.6 \pm 0.5) \times 10^{-4}$		DESIG=106

Г ₁₀₇	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^+ \pi^-$	$(9.4 \pm 2.8) \times 10^{-7}$		DESIG=280
Г ₁₀₈	$\phi f_1(1285) \rightarrow \phi \pi^0 f_0(980) \rightarrow \phi \pi^0 \pi^0 \pi^0$	$(2.1 \pm 2.2) \times 10^{-7}$		DESIG=281
Г ₁₀₉	$\eta \pi^+ \pi^-$	$(3.8 \pm 0.7) \times 10^{-4}$		DESIG=239
Г ₁₁₀	$\eta \rho$	$(1.93 \pm 0.23) \times 10^{-4}$		DESIG=22
Г ₁₁₁	$\omega \eta'(958)$	$(1.89 \pm 0.18) \times 10^{-4}$		DESIG=31
Г ₁₁₂	$\omega f_0(980)$	$(1.4 \pm 0.5) \times 10^{-4}$		DESIG=150
Г ₁₁₃	$\rho \eta'(958)$	$(8.1 \pm 0.8) \times 10^{-5}$	S=1.6	DESIG=23
Г ₁₁₄	$a_2(1320)^\pm \pi^\mp$	$[b] < 4.3 \times 10^{-3}$	CL=90%	DESIG=42
Г ₁₁₅	$K \bar{K}_2^*(1430) + \text{c.c.}$	$< 4.0 \times 10^{-3}$	CL=90%	DESIG=45
Г ₁₁₆	$K_1(1270)^\pm K^\mp$	$< 3.0 \times 10^{-3}$	CL=90%	DESIG=131
Г ₁₁₇	$K_1(1270) K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5) \times 10^{-7}$		DESIG=377
Г ₁₁₈	$K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.}$	$(3.6 \pm 1.8) \times 10^{-3}$		DESIG=301
Г ₁₁₉	$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90%	DESIG=47
Г ₁₂₀	$\phi \pi^0$	$3 \times 10^{-6} \text{ or } 1 \times 10^{-7}$		DESIG=33; OUR EVAL; → UNCHECKED ←
Г ₁₂₁	$\phi \eta(1405) \rightarrow \phi \eta \pi^+ \pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$		DESIG=128
Г ₁₂₂	$\omega f_2'(1525)$	$< 2.2 \times 10^{-4}$	CL=90%	DESIG=29
Г ₁₂₃	$\omega X(1835) \rightarrow \omega p \bar{p}$	$< 3.9 \times 10^{-6}$	CL=95%	DESIG=263
Г ₁₂₄	$\omega X(1835), X \rightarrow \eta' \pi^+ \pi^-$	$< 6.2 \times 10^{-5}$		DESIG=386
Г ₁₂₅	$\phi X(1835) \rightarrow \phi p \bar{p}$	$< 2.1 \times 10^{-7}$	CL=90%	DESIG=291
Г ₁₂₆	$\phi X(1835) \rightarrow \phi \eta \pi^+ \pi^-$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=288
Г ₁₂₇	$\phi X(1870) \rightarrow \phi \eta \pi^+ \pi^-$	$< 6.13 \times 10^{-5}$	CL=90%	DESIG=289
Г ₁₂₈	$\eta \phi(2170) \rightarrow \eta \phi f_0(980) \rightarrow \eta \phi \pi^+ \pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$		DESIG=287
Г ₁₂₉	$\eta \phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0$	$< 2.52 \times 10^{-4}$	CL=90%	DESIG=253
Г ₁₃₀	$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	$< 8.2 \times 10^{-6}$	CL=90%	DESIG=111
Г ₁₃₁	$\Delta(1232)^+ \bar{p}$	$< 1 \times 10^{-4}$	CL=90%	DESIG=112
Г ₁₃₂	$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	$< 4.1 \times 10^{-6}$	CL=90%	DESIG=260
Г ₁₃₃	$\bar{\Lambda}(1520) \Lambda + \text{c.c.}$	$< 1.80 \times 10^{-3}$	CL=90%	DESIG=364
Г ₁₃₄	$\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=205
Г ₁₃₅	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 2.1 \times 10^{-5}$	CL=90%	DESIG=206
Г ₁₃₆	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 1.6 \times 10^{-5}$	CL=90%	DESIG=207
Г ₁₃₇	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 5.6 \times 10^{-5}$	CL=90%	DESIG=208
Г ₁₃₈	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=209

Decays into stable hadrons

Г ₁₃₉	$2(\pi^+ \pi^-) \pi^0$	$(3.73 \pm 0.32) \%$	S=1.4	DESIG=9
Г ₁₄₀	$3(\pi^+ \pi^-) \pi^0$	$(2.9 \pm 0.6) \%$		DESIG=11
Г ₁₄₁	$\pi^+ \pi^- \pi^0$	$(2.10 \pm 0.08) \%$	S=1.6	DESIG=7
Г ₁₄₂	$\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	$(2.71 \pm 0.29) \%$		DESIG=358
Г ₁₄₃	$\rho^\pm \pi^\mp \pi^0 \pi^0$	$(1.41 \pm 0.22) \%$		DESIG=362
Г ₁₄₄	$\rho^+ \rho^- \pi^0$	$(6.0 \pm 1.1) \times 10^{-3}$		DESIG=363
Г ₁₄₅	$\pi^+ \pi^- \pi^0 K^+ K^-$	$(1.20 \pm 0.30) \%$		DESIG=18
Г ₁₄₆	$4(\pi^+ \pi^-) \pi^0$	$(9.0 \pm 3.0) \times 10^{-3}$		DESIG=12
Г ₁₄₇	$\pi^+ \pi^- K^+ K^-$	$(6.86 \pm 0.28) \times 10^{-3}$		DESIG=16
Г ₁₄₈	$\pi^+ \pi^- K_S^0 K_L^0$	$(3.8 \pm 0.6) \times 10^{-3}$		DESIG=296
Г ₁₄₉	$\pi^+ \pi^- K_S^0 K_S^0$	$(1.68 \pm 0.19) \times 10^{-3}$		DESIG=297
Г ₁₅₀	$\pi^\pm \pi^0 K^\mp K_S^0$	$(5.7 \pm 0.5) \times 10^{-3}$		DESIG=341
Г ₁₅₁	$K^+ K^- K_S^0 K_S^0$	$(4.2 \pm 0.7) \times 10^{-4}$		DESIG=298
Г ₁₅₂	$\pi^+ \pi^- K^+ K^- \eta$	$(4.7 \pm 0.7) \times 10^{-3}$		DESIG=238
Г ₁₅₃	$\pi^0 \pi^0 K^+ K^-$	$(2.13 \pm 0.22) \times 10^{-3}$		DESIG=234
Г ₁₅₄	$\pi^0 \pi^0 K_S^0 K_L^0$	$(1.9 \pm 0.4) \times 10^{-3}$		DESIG=337
Г ₁₅₅	$K \bar{K} \pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=15
Г ₁₅₆	$K^+ K^- \pi^0$	$(2.88 \pm 0.12) \times 10^{-3}$		DESIG=334
Г ₁₅₇	$K_S^0 K^\pm \pi^\mp$	$(5.6 \pm 0.5) \times 10^{-3}$		DESIG=335
Г ₁₅₈	$K_S^0 K_L^0 \pi^0$	$(2.06 \pm 0.26) \times 10^{-3}$		DESIG=336

NODE=M070; CLUMP=B

Γ ₁₅₉	$K^*(892)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0$	$(1.21 \pm 0.18) \times 10^{-3}$		DESIG=339
Γ ₁₆₀	$K_2^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0$	$(4.3 \pm 1.3) \times 10^{-4}$		DESIG=338
Γ ₁₆₁	$K_S^0 K_L^0 \eta$	$(1.45 \pm 0.33) \times 10^{-3}$		DESIG=340
Γ ₁₆₂	$2(\pi^+ \pi^-)$	$(3.57 \pm 0.30) \times 10^{-3}$		DESIG=8
Γ ₁₆₃	$3(\pi^+ \pi^-)$	$(4.3 \pm 0.4) \times 10^{-3}$		DESIG=10
Γ ₁₆₄	$2(\pi^+ \pi^- \pi^0)$	$(1.61 \pm 0.20) \%$		DESIG=210
Γ ₁₆₅	$2(\pi^+ \pi^-) \eta$	$(2.26 \pm 0.28) \times 10^{-3}$		DESIG=201
Γ ₁₆₆	$3(\pi^+ \pi^-) \eta$	$(7.2 \pm 1.5) \times 10^{-4}$		DESIG=202
Γ ₁₆₇	$\pi^+ \pi^- \pi^0 \pi^0 \eta$	$(2.3 \pm 0.5) \times 10^{-3}$		DESIG=359
Γ ₁₆₈	$\rho^\pm \pi^\mp \pi^0 \eta$	$(1.9 \pm 0.8) \times 10^{-3}$		DESIG=361
Γ ₁₆₉	$p \bar{p}$	$(2.121 \pm 0.029) \times 10^{-3}$		DESIG=50
Γ ₁₇₀	$p \bar{p} \pi^0$	$(1.19 \pm 0.08) \times 10^{-3}$	S=1.1	DESIG=52
Γ ₁₇₁	$p \bar{p} \pi^+ \pi^-$	$(6.0 \pm 0.5) \times 10^{-3}$	S=1.3	DESIG=54
Γ ₁₇₂	$p \bar{p} \pi^+ \pi^- \pi^0$	[c] $(2.3 \pm 0.9) \times 10^{-3}$	S=1.9	DESIG=55
Γ ₁₇₃	$p \bar{p} \eta$	$(2.00 \pm 0.12) \times 10^{-3}$		DESIG=56
Γ ₁₇₄	$p \bar{p} \rho$	< 3.1 $\times 10^{-4}$	CL=90%	DESIG=57
Γ ₁₇₅	$p \bar{p} \omega$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.3	DESIG=58
Γ ₁₇₆	$p \bar{p} \eta'(958)$	$(1.29 \pm 0.14) \times 10^{-4}$	S=2.0	DESIG=59
Γ ₁₇₇	$p \bar{p} a_0(980) \rightarrow p \bar{p} \pi^0 \eta$	$(6.8 \pm 1.8) \times 10^{-5}$		DESIG=276
Γ ₁₇₈	$p \bar{p} \phi$	$(5.19 \pm 0.33) \times 10^{-5}$		DESIG=127
Γ ₁₇₉	$n \bar{n}$	$(2.09 \pm 0.16) \times 10^{-3}$		DESIG=64
Γ ₁₈₀	$n \bar{n} \pi^+ \pi^-$	$(4 \pm 4) \times 10^{-3}$		DESIG=65
Γ ₁₈₁	$\Sigma^+ \bar{\Sigma}^-$	$(1.50 \pm 0.24) \times 10^{-3}$		DESIG=247
Γ ₁₈₂	$\Sigma^0 \bar{\Sigma}^0$	$(1.172 \pm 0.032) \times 10^{-3}$	S=1.4	DESIG=63
Γ ₁₈₃	$2(\pi^+ \pi^-) K^+ K^-$	$(3.1 \pm 1.3) \times 10^{-3}$		DESIG=17
Γ ₁₈₄	$p \bar{n} \pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		DESIG=53
Γ ₁₈₅	$n N(1440)$	seen		DESIG=215;OUR EST;→ UNCHECKED ←
Γ ₁₈₆	$n N(1520)$	seen		DESIG=216;OUR EST;→ UNCHECKED ←
Γ ₁₈₇	$n N(1535)$	seen		DESIG=217;OUR EST;→ UNCHECKED ←
Γ ₁₈₈	$\Xi^- \bar{\Xi}^+$	$(9.7 \pm 0.8) \times 10^{-4}$	S=1.4	DESIG=62
Γ ₁₈₉	$\Lambda \bar{\Lambda}$	$(1.89 \pm 0.09) \times 10^{-3}$	S=2.8	DESIG=60
Γ ₁₉₀	$\Lambda \bar{\Sigma}^- \pi^+ (\text{or c.c.})$	[b] $(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	DESIG=71
Γ ₁₉₁	$p K^- \bar{\Lambda} + \text{c.c.}$	$(8.7 \pm 1.1) \times 10^{-4}$		DESIG=72
Γ ₁₉₂	$2(K^+ K^-)$	$(7.2 \pm 0.8) \times 10^{-4}$		DESIG=19
Γ ₁₉₃	$p K^- \bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		DESIG=73
Γ ₁₉₄	$K^+ K^-$	$(2.86 \pm 0.21) \times 10^{-4}$		DESIG=13
Γ ₁₉₅	$K_S^0 K_L^0$	$(1.95 \pm 0.11) \times 10^{-4}$	S=2.4	DESIG=75
Γ ₁₉₆	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		DESIG=261
Γ ₁₉₇	$\Lambda \bar{\Lambda} \eta$	$(1.62 \pm 0.17) \times 10^{-4}$		DESIG=228
Γ ₁₉₈	$\Lambda \bar{\Lambda} \pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		DESIG=109
Γ ₁₉₉	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		DESIG=225
Γ ₂₀₀	$\pi^+ \pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		DESIG=6
Γ ₂₀₁	$\Lambda \bar{\Sigma} + \text{c.c.}$	$(2.83 \pm 0.23) \times 10^{-5}$		DESIG=61
Γ ₂₀₂	$K_S^0 K_S^0$	< 1.4 $\times 10^{-8}$	CL=95%	DESIG=14

Radiative decays

Γ ₂₀₃	3γ	$(1.16 \pm 0.22) \times 10^{-5}$		NODE=M070;CLUMP=C DESIG=81
Γ ₂₀₄	4γ	< 9 $\times 10^{-6}$	CL=90%	DESIG=244
Γ ₂₀₅	5γ	< 1.5 $\times 10^{-5}$	CL=90%	DESIG=245
Γ ₂₀₆	$\gamma \pi^0 \pi^0$	$(1.15 \pm 0.05) \times 10^{-3}$		DESIG=283
Γ ₂₀₇	$\gamma \eta \pi^0$	$(2.14 \pm 0.31) \times 10^{-5}$		DESIG=292
Γ ₂₀₈	$\gamma a_0(980)^0 \rightarrow \gamma \eta \pi^0$	< 2.5 $\times 10^{-6}$	CL=95%	DESIG=293
Γ ₂₀₉	$\gamma a_2(1320)^0 \rightarrow \gamma \eta \pi^0$	< 6.6 $\times 10^{-6}$	CL=95%	DESIG=294
Γ ₂₁₀	$\gamma K_S^0 K_S^0$	$(8.1 \pm 0.4) \times 10^{-4}$		DESIG=378
Γ ₂₁₁	$\gamma \eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.5	DESIG=85
Γ ₂₁₂	$\gamma \eta_c(1S) \rightarrow 3\gamma$	$(3.8 \pm \frac{1.3}{1.0}) \times 10^{-6}$	S=1.1	DESIG=246
Γ ₂₁₃	$\gamma \pi^+ \pi^- 2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		DESIG=99
Γ ₂₁₄	$\gamma \eta \pi \pi$	$(6.1 \pm 1.0) \times 10^{-3}$		DESIG=96

Г ₂₁₅	$\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		DESIG=142
Г ₂₁₆	$\gamma\eta(1405/1475) \rightarrow \gamma K\bar{K}\pi$	[d] $(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	DESIG=89
Г ₂₁₇	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	DESIG=171
Г ₂₁₈	$\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=170
Г ₂₁₉	$\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi$	$< 8.2 \times 10^{-5}$	CL=95%	DESIG=212
Г ₂₂₀	$\gamma\eta(1405) \rightarrow \gamma\gamma\gamma$	$< 2.63 \times 10^{-6}$	CL=90%	DESIG=348
Г ₂₂₁	$\gamma\eta(1475) \rightarrow \gamma\gamma\gamma$	$< 1.86 \times 10^{-6}$	CL=90%	DESIG=349
Г ₂₂₂	$\gamma\rho\rho$	$(4.5 \pm 0.8) \times 10^{-3}$		DESIG=94
Г ₂₂₃	$\gamma\rho\omega$	$< 5.4 \times 10^{-4}$	CL=90%	DESIG=226
Г ₂₂₄	$\gamma\rho\phi$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=227
Г ₂₂₅	$\gamma\eta'(958)$	$(5.25 \pm 0.07) \times 10^{-3}$	S=1.3	DESIG=84
Г ₂₂₆	$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	DESIG=95
Г ₂₂₇	$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		DESIG=203
Г ₂₂₈	$\gamma f_2(1270) f_2(1270) (\text{non resonant})$	$(8.2 \pm 1.9) \times 10^{-4}$		DESIG=204
Г ₂₂₉	$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		DESIG=143
Г ₂₃₀	$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		DESIG=100
Г ₂₃₁	$\gamma\omega\omega$	$(1.61 \pm 0.33) \times 10^{-3}$		DESIG=97
Г ₂₃₂	$\gamma\eta(1405/1475) \rightarrow \gamma\rho^0\rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	DESIG=124
Г ₂₃₃	$\gamma f_2(1270)$	$(1.64 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=86
Г ₂₃₄	$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.58 \pm 0.60) \times 10^{-5}$		DESIG=373
Г ₂₃₅	$\gamma f_0(1370) \rightarrow \gamma K\bar{K}$	$(4.2 \pm 1.5) \times 10^{-4}$		DESIG=284
Г ₂₃₆	$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.1 \pm 0.4) \times 10^{-5}$		DESIG=368
Г ₂₃₇	$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \pm 0.24) \times 10^{-5}$		DESIG=369
Г ₂₃₈	$\gamma f_0(1710) \rightarrow \gamma K\bar{K}$	$(9.5 \pm 1.0) \times 10^{-4}$	S=1.5	DESIG=91
Г ₂₃₉	$\gamma f_0(1710) \rightarrow \gamma\pi\pi$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=135
Г ₂₄₀	$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		DESIG=221
Г ₂₄₁	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	$(2.4 \pm 1.2) \times 10^{-4}$		DESIG=266
Г ₂₄₂	$\gamma\eta$	$(1.108 \pm 0.027) \times 10^{-3}$		DESIG=83
Г ₂₄₃	$\gamma f_1(1420) \rightarrow \gamma K\bar{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		DESIG=175
Г ₂₄₄	$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		DESIG=88
Г ₂₄₅	$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		DESIG=141
Г ₂₄₆	$\gamma f_2'(1525)$	$(5.7 \pm 0.8) \times 10^{-4}$	S=1.5	DESIG=87
Г ₂₄₇	$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \pm 0.7) \times 10^{-5}$		DESIG=374
Г ₂₄₈	$\gamma f_2'(1525) \rightarrow \gamma\eta\eta$	$(3.4 \pm 1.4) \times 10^{-5}$		DESIG=268
Г ₂₄₉	$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		DESIG=222
Г ₂₅₀	$\gamma f_2(1910) \rightarrow \gamma\omega\omega$	$(2.0 \pm 1.4) \times 10^{-4}$		DESIG=223
Г ₂₅₁	$\gamma f_0(1750) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \pm 0.20) \times 10^{-5}$		DESIG=370
Г ₂₅₂	$\gamma f_0(1800) \rightarrow \gamma\omega\phi$	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=262
Г ₂₅₃	$\gamma f_2(1810) \rightarrow \gamma\eta\eta$	$(5.4 \pm 3.5) \times 10^{-5}$		DESIG=269
Г ₂₅₄	$\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		DESIG=144
Г ₂₅₅	$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		DESIG=145
Г ₂₅₆	$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=98
Г ₂₅₇	$\gamma p\bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		DESIG=90
Г ₂₅₈	$\gamma\eta(2225)$	$(3.14 \pm 0.50) \times 10^{-4}$		DESIG=126
Г ₂₅₉	$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		DESIG=125
Г ₂₆₀	$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		DESIG=224
Г ₂₆₁	$\gamma\eta(1760) \rightarrow \gamma\gamma\gamma$	$< 4.80 \times 10^{-6}$	CL=90%	DESIG=347
Г ₂₆₂	$\gamma X(1835) \rightarrow \gamma\pi^+\pi^-\eta'$	$(2.7 \pm 0.6) \times 10^{-4}$	S=1.6	DESIG=213
Г ₂₆₃	$\gamma X(1835) \rightarrow \gamma p\bar{p}$	$(7.7 \pm 1.5) \times 10^{-5}$		DESIG=254

Γ_{264}	$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \pm 2.0_{-1.3}) \times 10^{-5}$		DESIG=282
Γ_{265}	$\gamma X(1835) \rightarrow \gamma \gamma \phi(1020)$			DESIG=346
Γ_{266}	$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	< 3.56	$\times 10^{-6}$	CL=90% DESIG=350
Γ_{267}	$\gamma X(2370) \rightarrow \gamma K^+ K^- \eta'$	$(1.8 \pm 0.7) \times 10^{-5}$		DESIG=388
Γ_{268}	$\gamma X(2370) \rightarrow \gamma K_S^0 K_S^0 \eta'$	$(1.2 \pm 0.5) \times 10^{-5}$		DESIG=389
Γ_{269}	$\gamma X(1840) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm 0.7_{-0.8}) \times 10^{-5}$		DESIG=264
Γ_{270}	$\gamma(K\bar{K}\pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	DESIG=176
Γ_{271}	$\gamma \pi^0$	$(3.56 \pm 0.17) \times 10^{-5}$		DESIG=82
Γ_{272}	$\gamma p \bar{p} \pi^+ \pi^-$	< 7.9	$\times 10^{-4}$	CL=90% DESIG=93
Γ_{273}	$\gamma \Lambda \bar{\Lambda}$	< 1.3	$\times 10^{-4}$	CL=90% DESIG=200
Γ_{274}	$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	$(1.13 \pm 0.60_{-0.30}) \times 10^{-4}$		DESIG=267
Γ_{275}	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	$(6.2 \pm 1.0) \times 10^{-4}$		DESIG=286
Γ_{276}	$\gamma f_0(2200)$			DESIG=123
Γ_{277}	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	$(5.9 \pm 1.3) \times 10^{-4}$		DESIG=285
Γ_{278}	$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	$(2.72 \pm 0.19_{-0.50}) \times 10^{-4}$		DESIG=371
Γ_{279}	$\gamma f_J(2220)$			DESIG=92
Γ_{280}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 3.9	$\times 10^{-5}$	CL=90% DESIG=136
Γ_{281}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 4.1	$\times 10^{-5}$	CL=90% DESIG=137
Γ_{282}	$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		DESIG=138
Γ_{283}	$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	$(4.9 \pm 0.7) \times 10^{-5}$		DESIG=372
Γ_{284}	$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	$(5.6 \pm 2.4_{-2.2}) \times 10^{-5}$		DESIG=270
Γ_{285}	$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	$(5.5 \pm 4.0_{-1.5}) \times 10^{-5}$		DESIG=375
Γ_{286}	$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	$(1.09 \pm 0.24) \times 10^{-4}$		DESIG=172
Γ_{287}	$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	$(1.7 \pm 0.6_{-1.4}) \times 10^{-5}$		DESIG=265
Γ_{288}	$\gamma A \rightarrow \gamma \text{invisible}$	$[e] < 1.7$	$\times 10^{-6}$	CL=90% DESIG=251
Γ_{289}	$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	$[f] < 5$	$\times 10^{-6}$	CL=90% DESIG=259

Dalitz decays

Γ_{290}	$\pi^0 e^+ e^-$	$(7.6 \pm 1.4) \times 10^{-7}$		NODE=M070;CLUMP=G DESIG=271
Γ_{291}	$\eta e^+ e^-$	$(1.43 \pm 0.07) \times 10^{-5}$		DESIG=272
Γ_{292}	$\eta'(958) e^+ e^-$	$(6.59 \pm 0.18) \times 10^{-5}$		DESIG=273
Γ_{293}	$\eta U \rightarrow \eta e^+ e^-$	< 9.11	$\times 10^{-7}$	CL=90% DESIG=352
Γ_{294}	$\eta'(958) U \rightarrow \eta'(958) e^+ e^-$	< 2.0	$\times 10^{-7}$	CL=90% DESIG=366
Γ_{295}	$\phi e^+ e^-$	< 1.2	$\times 10^{-7}$	CL=90% DESIG=384

Weak decays

Γ_{296}	$D^- e^+ \nu_e + \text{c.c.}$	< 1.2	$\times 10^{-5}$	CL=90% NODE=M070;CLUMP=E DESIG=218
Γ_{297}	$\bar{D}^0 e^+ e^- + \text{c.c.}$	< 8.5	$\times 10^{-8}$	CL=90% DESIG=219
Γ_{298}	$D_s^- e^+ \nu_e + \text{c.c.}$	< 1.3	$\times 10^{-6}$	CL=90% DESIG=220
Γ_{299}	$D_s^{*-} e^+ \nu_e + \text{c.c.}$	< 1.8	$\times 10^{-6}$	CL=90% DESIG=290
Γ_{300}	$D^- \pi^+ + \text{c.c.}$	< 7.5	$\times 10^{-5}$	CL=90% DESIG=241
Γ_{301}	$\bar{D}^0 \bar{K}^0 + \text{c.c.}$	< 1.7	$\times 10^{-4}$	CL=90% DESIG=242
Γ_{302}	$\bar{D}^0 \bar{K}^{*0} + \text{c.c.}$	< 2.5	$\times 10^{-6}$	CL=90% DESIG=275
Γ_{303}	$D_s^- \pi^+ + \text{c.c.}$	< 1.3	$\times 10^{-4}$	CL=90% DESIG=243
Γ_{304}	$D_s^- \rho^+ + \text{c.c.}$	< 1.3	$\times 10^{-5}$	CL=90% DESIG=274

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

Γ_{305}	$\gamma \gamma$	C	< 2.7	$\times 10^{-7}$	CL=90% NODE=M070;CLUMP=D DESIG=80
Γ_{306}	$\gamma \phi$	C	< 1.4	$\times 10^{-6}$	CL=90% DESIG=277
Γ_{307}	$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90% DESIG=177
Γ_{308}	$e^\pm \tau^\mp$	LF	< 8.3	$\times 10^{-6}$	CL=90% DESIG=178
Γ_{309}	$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90% DESIG=179
Γ_{310}	$\Lambda_c^+ e^- + \text{c.c.}$		< 6.9	$\times 10^{-8}$	CL=90% DESIG=379

Other decays
 Γ_{311} 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] Includes $p\bar{p}\pi^+\pi^-\gamma$ and excludes $p\bar{p}\eta$, $p\bar{p}\omega$, $p\bar{p}\eta'$.

LINKAGE=MF

 [d] See the "Note on the $\eta(1405)$ " in the $\eta(1405)$ Particle Listings.

LINKAGE=MG

 [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 0.21–3.0 GeV.

LINKAGE=NA0

 $J/\psi(1S)$ PARTIAL WIDTHS **$\Gamma(\text{hadrons})$** **Γ_1**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
81.37 ± 1.36 ± 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^-

¹ Based on the same dataset as ANASHIN 18A and correlated to the values reported there

NODE=M070220

 NODE=M070W3
 NODE=M070W3
 $\Gamma(e^+e^-)$ **Γ_5**

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
5.53 ± 0.10 OUR AVERAGE				
5.550 ± 0.056 ± 0.089		^{1,2} ANASHIN	18A	KEDR e^+e^-
5.36 ^{+0.29} _{-0.28}		³ HSUEH	92	RVUE See Υ mini-review
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.58 ± 0.05 ± 0.08		⁴ ABLIKIM	16Q	BES3 $3.773 e^+e^- \rightarrow \mu^+\mu^-\gamma$
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 Υ 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 $e^+e^- \rightarrow \text{hadrons}$ 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=M070W3;LINKAGE=A

 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_{305}**

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 i in the $e^+ e^-$ annihilation.

NODE=M070225

NODE=M070225

$$\Gamma(\text{hadrons}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$
 $\Gamma_1 \Gamma_5 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

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

$4.884 \pm 0.048 \pm 0.078$	^{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 $e^+ e^- \rightarrow \text{hadrons}$ 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

NODE=M070G3

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. • • •

$333.1 \pm 6.6 \pm 4.0$	^{1,2} ANASHIN	18A	KEDR $e^+ e^-$

$332.3 \pm 6.4 \pm 4.8$	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 $e^+ e^- \rightarrow \text{hadrons}$ 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

$333.4 \pm 2.5 \pm 4.4$		ABLIKIM	16Q	BES3 $3.773 e^+ e^- \rightarrow \mu^+ \mu^- \gamma$

$331.8 \pm 5.2 \pm 6.3$		ANASHIN	10	KEDR $3.097 e^+ e^- \rightarrow \mu^+ \mu^-$

$338.4 \pm 5.8 \pm 7.1$	13k	ADAMS	06A	CLEO $e^+ e^- \rightarrow \mu^+ \mu^- \gamma$

$330.1 \pm 7.7 \pm 7.3$	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

$$\Gamma(\rho(770)^\mp K^\pm K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$
 $\Gamma_{10} \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

$10.4 \pm 1.0 \pm 1.9$	130	LEES	17D	BABR $e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

NODE=M070G31

NODE=M070G31

$$\Gamma(\omega \pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$
 $\Gamma_{23} \Gamma_5 / \Gamma$

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

$2.2 \pm 0.3 \pm 0.2$	170	AUBERT	06D	BABR $10.6 e^+ e^- \rightarrow \omega \pi^+ \pi^- \pi^0 \gamma$

NODE=M070G8

NODE=M070G8

$$\Gamma(\omega \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$
 $\Gamma_{24} \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

$53.6 \pm 5.0 \pm 0.4$	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 $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G24;LINKAGE=AU

$$\Gamma(\omega \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$$
 $\Gamma_{62} \Gamma_5 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

$27.8 \pm 3.5 \pm 0.2$	398	¹ LEES	18E	BABR $10.6 e^+ e^- \rightarrow \pi^+ \pi^- 3 \pi^0 \gamma$

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 $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P54;LINKAGE=A

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{26} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.28±0.34±0.07	47±12	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

• • • 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 $B(K^{*0} \rightarrow K^+ \pi^-) = 2/3 B(K^{*0} \rightarrow K \pi)$.

² Superseded by LEES 12F.

NODE=M070G01
NODE=M070G01

NODE=M070G01;LINKAGE=AE

NODE=M070G01;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^*(892)^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{27} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.80±0.48±0.32	1±5	¹ LEES	14H BABR	$e^+ e^- \rightarrow \pi^+ \pi^- K_S^0 K_S^0 \gamma$

¹ Dividing by $(1/4)^2$ to take twice into account $B(K^*(892) \rightarrow K_S^0 \pi) = 1/4$.

NODE=M070GY8
NODE=M070GY8

NODE=M070GY8;LINKAGE=A

$$\Gamma(K_S^0 \pi^- K^*(892)^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{29} \Gamma_5 / \Gamma$$

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	$e^+ e^- \rightarrow \pi^\mp \pi^- K_S^0 K_S^0 \gamma$

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
NODE=M070GY4

NODE=M070GY4;LINKAGE=B

NODE=M070GY4;LINKAGE=A

$$\Gamma(K_S^0 \pi^- K^*(892)^+ + \text{c.c.} \rightarrow K_S^0 K_S^0 \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{30} \Gamma_5 / \Gamma$$

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

$$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{46} \Gamma_5 / \Gamma$$

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 $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 12.89 \pm 0.54 \pm 0.41$ 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 $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 16.4 \pm 1.1 \pm 1.4$ 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

$$\Gamma(K^*(892)^+ K_2^*(1430)^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{47} \Gamma_5 / \Gamma$$

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 $[\Gamma(J/\psi(1S) \rightarrow K^*(892)^+ K_2^*(1430)^- + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 9.28 \pm 8.0 \pm 0.32$ 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

$$\Gamma(K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow K^*(892)^+ K_S^0 \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{48} \Gamma_5 / \Gamma$$

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

$$\Gamma(K^*(892)^0 \bar{K}_2(1770)^0 + \text{c.c.} \rightarrow K^*(892)^0 K^- \pi^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{49} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$3.8 \pm 0.4 \pm 0.3$	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

$$\Gamma(K^+ K^*(892)^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{53} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
$29.0 \pm 1.7 \pm 1.3$	AUBERT 08S BABR	10.6	$e^+ e^- \rightarrow K^+ K^*(892)^- \gamma$

NODE=M070G18
NODE=M070G18

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{54} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$10.96 \pm 0.85 \pm 0.70$	155	AUBERT 08S BABR	10.6	$e^+ e^- \rightarrow K^+ K^- \pi^0 \gamma$

NODE=M070G20
NODE=M070G20

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{54} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.69 \pm 0.01^{+0.13}_{-0.20}$	183k	ABLIKIM 19AQ BES	J/ψ	$\rightarrow K^+ K^- \pi^0$

NODE=M070P79
NODE=M070P79

$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{55} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$16.76 \pm 1.70 \pm 1.00$	89	AUBERT 08S BABR	10.6	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G21
NODE=M070G21

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{56} \Gamma_5 / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
$26.6 \pm 2.5 \pm 1.5$	AUBERT 08S BABR	10.6	$e^+ e^- \rightarrow K^0 \bar{K}^*(892)^0 \gamma$

NODE=M070G19
NODE=M070G19

$$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow K^0 K^\pm \pi^\mp + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{57} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$17.70 \pm 1.70 \pm 1.00$	94	AUBERT 08S BABR	10.6	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \gamma$

NODE=M070G22
NODE=M070G22

$$\Gamma(K_S^0 K^*(892)^0 \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}} \quad \Gamma_{31} / \Gamma$$

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
$6.28^{+0.16+0.59}_{-0.17-0.52}$	ABLIKIM 18AA BES3	J/ψ	$\rightarrow \gamma K_S^0 K_S^0$

NODE=M070P71
NODE=M070P71

$$\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{59} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$42.6 \pm 4.8 \pm 7.2$	99	¹ LEES 17D BABR	$e^+ e^-$	$\rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

¹ Dividing by 1/6 to account for $B(K^*(892)^0 \rightarrow K_S^0 \pi^0) = 1/6$.

NODE=M070G39
NODE=M070G39

NODE=M070G39;LINKAGE=A

$$\Gamma(K^*(892)^\pm K^\mp \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{60} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$22.8 \pm 2.8 \pm 6.8$	80	¹ LEES 17D BABR	$e^+ e^-$	$\rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

¹ Dividing by 1/4 to account for $B(K^*(892)^\pm \rightarrow K_S^0 \pi^\pm) = 1/4$.

NODE=M070G32
NODE=M070G32

NODE=M070G32;LINKAGE=A

$$\Gamma(K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{32} / \Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.69 \pm 0.04^{+0.25}_{-0.19}$	183k	ABLIKIM 19AQ BES	J/ψ	$\rightarrow K^+ K^- \pi^0$

NODE=M070P76
NODE=M070P76

$$\Gamma(K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{33} / \Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.1^{+0.6}_{-0.1}$	183k	ABLIKIM 19AQ BES	J/ψ	$\rightarrow K^+ K^- \pi^0$

NODE=M070P77
NODE=M070P77

$$\Gamma(K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{34} / \Gamma$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.2 \pm 0.7^{+2.8}_{-1.4}$	183k	ABLIKIM 19AQ BES	J/ψ	$\rightarrow K^+ K^- \pi^0$

NODE=M070P78
NODE=M070P78

$$\Gamma(K^*(892)^0 K_S^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{61} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.60±0.75±2.25	34	¹ LEES	17D BABR	$e^+ e^- \rightarrow K_S^0 K^\pm \pi^\mp \pi^0 \gamma$

¹ Dividing by 2/3 to account for $B(K^*(892)^0 \rightarrow K^+ \pi^-) = 2/3$.

NODE=M070G33
NODE=M070G33

NODE=M070G33;LINKAGE=A

$$\Gamma(\eta K^\pm K_S^0 \pi^\mp) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{67} \Gamma_5 / \Gamma$$

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

$$\Gamma(\omega K \bar{K}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{69} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.70±1.98±0.03	24	¹ AUBERT	07AU BABR	$10.6 e^+ e^- \rightarrow \omega K^+ K^- \gamma$

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 $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G29
NODE=M070G29

NODE=M070G29;LINKAGE=AU

$$\Gamma(\phi 2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{71} \Gamma_5 / \Gamma$$

VALUE (10^{-2} keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.95±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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G10
NODE=M070G10

NODE=M070G10;LINKAGE=AU

$$\Gamma(\phi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{76} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.25±0.84±0.03	29	¹ LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ1
NODE=M070GZ1

NODE=M070GZ1;LINKAGE=A

$$\Gamma(\phi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{78} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.59±0.62±0.05	163	¹ LEES	12F BABR	$10.6 e^+ e^- \rightarrow K^+ K^- K^+ K^- \gamma$

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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G09
NODE=M070G09

NODE=M070G09;LINKAGE=A

$$\Gamma(\phi f_2(1270)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{79} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.79±0.32^{+0.02}_{-0.06}	61	^{1,2,3} LEES	12F BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

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

4.08±0.73^{+0.04}_{-0.14}	44	^{2,4} AUBERT	07AK BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. 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 $\pi^+ \pi^-$ invariant mass between 1.1 and 1.5 GeV. May include other sources such as $f_0(1370)$.

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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. 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

$\Gamma(K^+K^-f'_2(1525)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_{83}\Gamma_5/\Gamma$

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 $[\Gamma(J/\psi(1S) \rightarrow K^+K^-f'_2(1525)) \times \Gamma(J/\psi(1S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K\bar{K})] = 5.12 \pm 1.68 \pm 0.20$ eV which we divide by our best value $B(f'_2(1525) \rightarrow K\bar{K}) = (87.6 \pm 2.2) \times 10^{-2}$. 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

 $\Gamma(\phi f'_2(1525)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_{84}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
8.2±3.2±0.2	11	^{1,2} LEES	14H BABR	$e^+e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GZ2
NODE=M070GZ2

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 $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M070GZ2;LINKAGE=A

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 $B(f'_2(1525) \rightarrow K\bar{K}) = (87.6 \pm 2.2) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070GZ2;LINKAGE=B

 $\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_{85}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.47±0.35 OUR AVERAGE				

NODE=M070G14
NODE=M070G14

4.45±0.49±0.05	181	¹ LEES	12F BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

4.50±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	$10.6 e^+e^- \rightarrow K^+K^-\pi^+\pi^-\gamma$

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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=B

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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=SH

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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G14;LINKAGE=AU

 $\Gamma(\phi\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_{86}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.76±0.57±0.03	45	¹ LEES	12F BABR	$10.6 e^+e^- \rightarrow K^+K^-\pi^0\pi^0\gamma$

NODE=M070G15
NODE=M070G15

• • • 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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=A

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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G15;LINKAGE=AU

 $\Gamma(\phi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_{89}\Gamma_5/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.1±2.7±0.4	6	¹ AUBERT	07AU BABR	$10.6 e^+e^- \rightarrow \phi\eta\gamma$

NODE=M070G28
NODE=M070G28

¹ 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;LINKAGE=AU

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{97} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.44 ± 0.19 OUR AVERAGE

1.40 ± 0.25 ± 0.02	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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best 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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G05
NODE=M070G05

NODE=M070G05;LINKAGE=A

NODE=M070G05;LINKAGE=SH

NODE=M070G05;LINKAGE=UB

$$\Gamma(\phi f_0(980) \rightarrow \phi \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{98} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.98 ± 0.26 ± 0.01	16 ± 4	¹ LEES	12F BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

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

0.95 ± 0.40 ± 0.01	7.0 ± 2.8	² AUBERT	07AK BABR	10.6 $e^+ e^- \rightarrow \pi^0 \pi^0 K^+ K^- \gamma$

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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best 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 $B(\phi(1020) \rightarrow K^+ K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G06
NODE=M070G06

NODE=M070G06;LINKAGE=A

NODE=M070G06;LINKAGE=UB

$$\Gamma(\eta \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{109} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

2.3 ± 0.4 OUR AVERAGE

2.34 ± 0.43 ± 0.16	49	LEES	18 BABR	$e^+ e^- \rightarrow \eta \pi^+ \pi^- \gamma$

2.23 ± 0.97 ± 0.03	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 $B(\eta \rightarrow \pi^+ \pi^- \pi^0) = (22.92 \pm 0.28) \times 10^{-2}$. 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

$$\Gamma(K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{118} \Gamma_5 / \Gamma$$

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 $[\Gamma(J/\psi(1S) \rightarrow K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.}) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(K_2^*(1430) \rightarrow K \pi)] = 10.0 \pm 4.8 \pm 0.8$ 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

$$\Gamma(2(\pi^+ \pi^-) \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{139} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^+ \pi^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{141} \Gamma_5 / \Gamma$$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

0.122 ± 0.005 ± 0.008	AUBERT,B	04N BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \gamma$

NODE=M070G5
NODE=M070G5

$$\Gamma(\pi^+ \pi^- \pi^0 \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{142} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

150.0 ± 4.0 ± 15.0	2.3k	LEES	18E BABR	10.6 $e^+ e^- \rightarrow \pi^+ \pi^- 3\pi^0 \gamma$

NODE=M070P53
NODE=M070P53

$$\Gamma(\rho^\pm \pi^\mp \pi^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{143} \Gamma_5 / \Gamma$$

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

$$\Gamma(\rho^+ \rho^- \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{144} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^+ \pi^- \pi^0 K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{145} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^+ \pi^- K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{147} \Gamma_5 / \Gamma$$

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=AU

$$\Gamma(\pi^+ \pi^- K_S^0 K_L^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{148} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^+ \pi^- K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{149} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^\pm \pi^0 K^\mp K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{150} \Gamma_5 / \Gamma$$

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

$$\Gamma(K^+ K^- K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{151} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.4 ± 0.1	29	LEES	14H BABR	$e^+ e^- \rightarrow K_S^0 K_S^0 K^+ K^- \gamma$

NODE=M070GY3
NODE=M070GY3

$$\Gamma(\pi^+ \pi^- K^+ K^- \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{152} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
25.9 ± 3.9 ± 0.1	73	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$

NODE=M070G30
NODE=M070G30

¹ AUBERT 07AU reports $[\Gamma(J/\psi(1S) \rightarrow \pi^+ \pi^- K^+ K^- \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 10.2 \pm 1.3 \pm 0.8$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

$$\Gamma(\pi^0 \pi^0 K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{153} \Gamma_5 / \Gamma$$

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

$$\Gamma(\pi^0 \pi^0 K_S^0 K_L^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{154} \Gamma_5 / \Gamma$$

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

$$\Gamma(K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{158} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
11.4 ± 1.3 ± 0.6	182	LEES	17A BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$

NODE=M070G41
NODE=M070G41

$$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_{159} \Gamma_5 / \Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
6.7 ± 0.9 ± 0.4	106	LEES	17A BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$

NODE=M070G42
NODE=M070G42

$\Gamma(K_2^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K_L^0 \pi^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{160} \Gamma_5 / \Gamma$					
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
2.4±0.7±0.1	37	LEES	17A	BABR	$e^+ e^- \rightarrow K_S^0 K_L^0 \pi^0 \gamma$

NODE=M070G43
NODE=M070G43

$\Gamma(K_S^0 K_L^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{161} \Gamma_5 / \Gamma$					
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

$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{162} \Gamma_5 / \Gamma$					
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

$\Gamma(3(\pi^+ \pi^-)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{163} \Gamma_5 / \Gamma$					
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

$\Gamma(2(\pi^+ \pi^- \pi^0)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{164} \Gamma_5 / \Gamma$					
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

$\Gamma(2(\pi^+ \pi^-) \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{165} \Gamma_5 / \Gamma$					
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
13.1±2.4±0.1	85	¹ AUBERT	07AU	BABR	$10.6 e^+ e^- \rightarrow 2(\pi^+ \pi^-) \eta \gamma$

NODE=M070G26
NODE=M070G26

¹ AUBERT 07AU reports [$\Gamma(J/\psi(1S) \rightarrow 2(\pi^+ \pi^-) \eta) \times \Gamma(J/\psi(1S) \rightarrow e^+ e^-) / \Gamma_{\text{total}}$] $\times [B(\eta \rightarrow 2\gamma)] = 5.16 \pm 0.85 \pm 0.39$ eV which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070G26;LINKAGE=AU

$\Gamma(\pi^+ \pi^- \pi^0 \pi^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{167} \Gamma_5 / \Gamma$					
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
12.8±1.8±2.0	203	LEES	18E	BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta \gamma$

NODE=M070P57
NODE=M070P57

$\Gamma(\omega \pi^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{63} \Gamma_5 / \Gamma$					
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 $B(\omega(782) \rightarrow \pi^+ \pi^- \pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070P58;LINKAGE=A

$\Gamma(\rho^\pm \pi^\mp \pi^0 \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{168} \Gamma_5 / \Gamma$					
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
10.5±4.1±1.6	168	LEES	18E	BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- \pi^0 \pi^0 \eta \gamma$

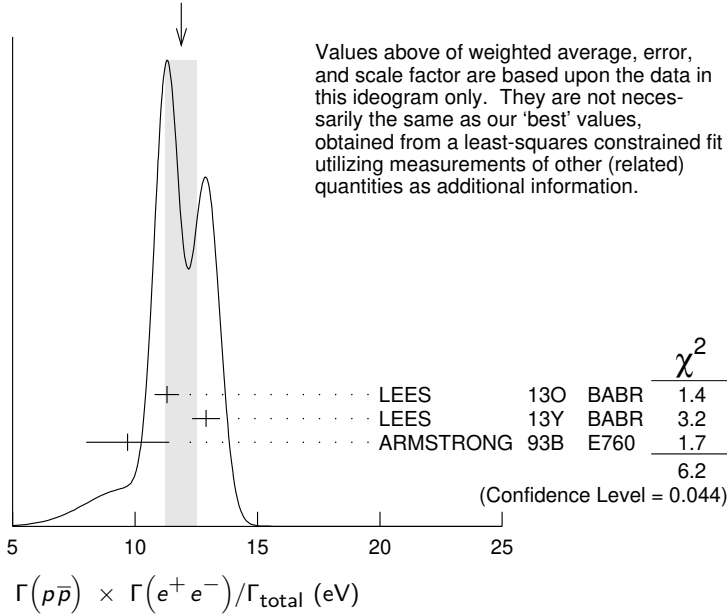
NODE=M070P59
NODE=M070P59

$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_{169}\Gamma_5/\Gamma$
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	130	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$
12.9±0.4±0.4	918	² LEES	13Y	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$
9.7±1.7		³ ARMSTRONG	93B	E760	$\bar{p}p \rightarrow e^+e^-$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
12.0±0.6±0.5	438	⁴ AUBERT	06B	BABR	$e^+e^- \rightarrow p\bar{p}\gamma$

- 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 130

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)



$\Gamma(\Sigma^0 \bar{\Sigma}^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{182}\Gamma_5/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
$6.4 \pm 1.2 \pm 0.6$	AUBERT	07BD BABR	$10.6 e^+e^- \rightarrow \Sigma^0 \bar{\Sigma}^0 \gamma$	

NODE=M070G17
 NODE=M070G17

$\Gamma(2(\pi^+\pi^-)K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{183}\Gamma_5/\Gamma$
VALUE (10^{-2} keV)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.75 \pm 0.23 \pm 0.17$	205	AUBERT	06D BABR	$10.6 e^+e^- \rightarrow K^+K^-2(\pi^+\pi^-)\gamma$

NODE=M070G9
 NODE=M070G9

$\Gamma(\Lambda \bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{189}\Gamma_5/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	
$10.7 \pm 0.9 \pm 0.7$	AUBERT	07BD BABR	$10.6 e^+e^- \rightarrow \Lambda \bar{\Lambda} \gamma$	

NODE=M070G16
 NODE=M070G16

$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{192}\Gamma_5/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4.00 \pm 0.33 \pm 0.29$	287 ± 24	LEES	12F BABR	$10.6 e^+e^- \rightarrow 2(K^+K^-)\gamma$

NODE=M070G13
 NODE=M070G13

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

$4.11 \pm 0.39 \pm 0.30$	156 ± 15	¹ AUBERT	07AK BABR	$10.6 e^+e^- \rightarrow 2(K^+K^-)\gamma$
$4.0 \pm 0.7 \pm 0.6$	38	² AUBERT	05D BABR	$10.6 e^+e^- \rightarrow 2(K^+K^-)\gamma$

¹ Superseded by LEES 12F.

² Superseded by AUBERT 07AK.

NODE=M070G13;LINKAGE=A
 NODE=M070G13;LINKAGE=AU

$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_{194}\Gamma_5/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M070G08
 NODE=M070G08

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

$1.78 \pm 0.11 \pm 0.05$	462	¹ LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
$1.94 \pm 0.11 \pm 0.05$	462	² LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
$1.42 \pm 0.23 \pm 0.08$	51	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=M070G08;LINKAGE=A
 NODE=M070G08;LINKAGE=B
 NODE=M070G08;LINKAGE=BA

$J/\psi(1S)$ 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

 $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE	DOCUMENT ID	TECN	COMMENT
0.877$\pm$0.005 OUR AVERAGE			
0.878 $\pm$ 0.005	BAI	95B	BES e^+e^-
0.86 $\pm$ 0.02	BOYARSKI	75	MRK1 e^+e^-

NODE=M070R3
NODE=M070R3 **$\Gamma(\text{virtual } \gamma \rightarrow \text{hadrons})/\Gamma_{\text{total}}$** **$\Gamma_2/\Gamma$**

VALUE	DOCUMENT ID	TECN	COMMENT
0.135$\pm$0.003	1,2 SETH	04	RVUE e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.17 $\pm$ 0.02	¹ BOYARSKI	75	MRK1 e^+e^-

NODE=M070R4
NODE=M070R4¹ Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.² 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.NODE=M070R4;LINKAGE=C
NODE=M070R4;LINKAGE=SE **$\Gamma(ggg)/\Gamma_{\text{total}}$** **$\Gamma_3/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
64.1$\pm$1.0	6 M	¹ BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- + \text{hadrons}$

NODE=M070S65
NODE=M070S65

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ 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;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.79$\pm$1.05	200 k	¹ BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^-\gamma + \text{hadrons}$

NODE=M070S66
NODE=M070S66

¹ Calculated using the value $\Gamma(\gamma gg)/\Gamma(ggg) = 0.137 \pm 0.001 \pm 0.016 \pm 0.004$ from BESSON 08 and the value of $\Gamma(ggg)/\Gamma_{\text{total}}$. The statistical error is negligible and the systematic error is partially correlated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ measurement of BESSON 08.

NODE=M070S66;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$ **Γ_4/Γ_3**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7$\pm$0.1$\pm$0.7	6 M	BESSON	08	CLEO $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$

NODE=M070S67
NODE=M070S67 **$\Gamma(e^+e^-)/\Gamma_{\text{total}}$** **$\Gamma_5/\Gamma$**

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.971$\pm$0.032 OUR AVERAGE				
5.983 $\pm$ 0.007 $\pm$ 0.037	720k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
5.945 $\pm$ 0.067 $\pm$ 0.042	15k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
5.90 $\pm$ 0.05 $\pm$ 0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
6.09 $\pm$ 0.33		BAI	95B	BES e^+e^-
5.92 $\pm$ 0.15 $\pm$ 0.20		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
6.9 $\pm$ 0.9		BOYARSKI	75	MRK1 e^+e^-

NODE=M070R1
NODE=M070R1 **$\Gamma(e^+e^-\gamma)/\Gamma_{\text{total}}$** **$\Gamma_6/\Gamma$**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
8.8$\pm$1.3$\pm$0.4	¹ ARMSTRONG	96	E760 $\bar{p}p \rightarrow e^+e^-\gamma$

NODE=M070S33
NODE=M070S33¹ For $E_\gamma > 100$ MeV.

NODE=M070S33;LINKAGE=A

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.961$\pm$0.033 OUR AVERAGE				
5.973 $\pm$ 0.007 $\pm$ 0.038	770k	ABLIKIM	13R	BES3 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
5.960 $\pm$ 0.065 $\pm$ 0.050	17k	LI	05C	CLEO $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
5.84 $\pm$ 0.06 $\pm$ 0.10		BAI	98D	BES $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
6.08 $\pm$ 0.33		BAI	95B	BES e^+e^-
5.90 $\pm$ 0.15 $\pm$ 0.19		COFFMAN	92	MRK3 $\psi(2S) \rightarrow J/\psi \pi^+\pi^-$
6.9 $\pm$ 0.9		BOYARSKI	75	MRK1 e^+e^-

NODE=M070R2
NODE=M070R2

$\Gamma(e^+e^-)/\Gamma(\mu^+\mu^-)$ Γ_5/Γ_7 NODE=M070R5
NODE=M070R5

VALUE	DOCUMENT ID	TECN	COMMENT
1.0016 ± 0.0031 OUR AVERAGE			
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^-

¹ 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

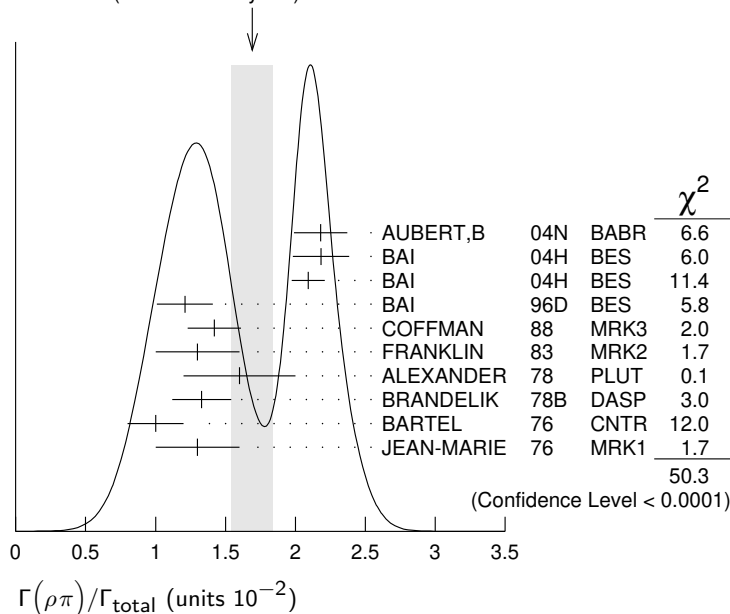
HADRONIC DECAYS

NODE=M070305

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_8/Γ NODE=M070R20
NODE=M070R20

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.69 ± 0.15 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
2.18 ± 0.19		^{1,2} AUBERT,B	04N BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-\pi^0\gamma$
2.184 ± 0.005 ± 0.201	220k	^{2,3} BAI	04H BES	$e^+e^- \rightarrow J/\psi \rightarrow \pi^+\pi^-\pi^0$
2.091 ± 0.021 ± 0.116		^{2,4} 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^-

OCCUR=2

¹ From the ratio of $\Gamma(e^+e^-) B(\pi^+\pi^-\pi^0)$ and $\Gamma(e^+e^-) B(\mu^+\mu^-)$ (AUBERT 04).² Not independent of their $B(\pi^+\pi^-\pi^0)$.³ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.⁴ 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=AU
NODE=M070R20;LINKAGE=BU
NODE=M070R20;LINKAGE=BA
NODE=M070R20;LINKAGE=BIWEIGHTED AVERAGE
1.69 ± 0.15 (Error scaled by 2.4)

$\Gamma(\rho\pi)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_8/Γ_{141}

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
1.142±0.011±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	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
¹ From a Dalitz plot analysis in an isobar model.				
² From a Dalitz plot analysis in a Veneziano model.				

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±0.005±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

 $\Gamma(\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{12}/Γ_{141}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
10.9 ±1.7 ±2.7	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.80±0.27	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=M070P25
 NODE=M070P25

OCCUR=2

NODE=M070P25;LINKAGE=A
 NODE=M070P25;LINKAGE=B

 $\Gamma(\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp)/\Gamma(K_S^0 K^\pm\pi^\mp)$ Γ_{13}/Γ_{157}

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
6.3±0.8±0.6	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=M070P31
 NODE=M070P31

NODE=M070P31;LINKAGE=A

 $\Gamma(\rho(1450)^0\pi^0 \rightarrow K^+K^-\pi^0)/\Gamma(K^+K^-\pi^0)$ Γ_{14}/Γ_{156}

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

 $\Gamma(\rho(1450)\eta'(958) \rightarrow \pi^+\pi^-\eta'(958))/\Gamma_{\text{total}}$ Γ_{15}/Γ

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

 $\Gamma(\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{17}/Γ_{141}

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

 $\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{19}/Γ_{141}

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

 $\Gamma(\rho_3(1690)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ Γ_{20}/Γ_{141}

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

$\Gamma(a_2(1320)\rho)/\Gamma_{\text{total}}$ 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_{21}/Γ

NODE=M070R43

NODE=M070R43

 $\Gamma(\omega \pi^+ \pi^+ \pi^- \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) EVTS**85±34**

140

DOCUMENT ID

TECN

COMMENT

VANNUCCI 77

MRK1

 $e^+ e^- \rightarrow 3(\pi^+ \pi^-) \pi^0$ Γ_{22}/Γ

NODE=M070R26

NODE=M070R26

 $\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**7.2±1.0 OUR AVERAGE**

7.0±1.6 18058

7.8±1.6 215

6.8±1.9 348

DOCUMENT ID

TECN

COMMENT

AUGUSTIN 89

DM2

 $J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$

BURMESTER 77D

PLUT

 $e^+ e^-$

VANNUCCI 77

MRK1

 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0$ Γ_{24}/Γ

NODE=M070R24

NODE=M070R24

 $\Gamma(\omega \eta' \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.12±0.02±0.13**

14k

DOCUMENT ID

TECN

COMMENT

¹ ABLIKIM

19AC

BES3

 $J/\psi \rightarrow \omega \eta' \pi^+ \pi^-$ ¹ Using the decays $\omega \rightarrow \pi^+ \pi^- \pi^0$ and $\eta' \rightarrow \eta \pi^+ \pi^-$. Γ_{74}/Γ

NODE=M070P83

NODE=M070P83

NODE=M070P83;LINKAGE=A

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**4.3±0.6 OUR AVERAGE**

4.3±0.2±0.6 5860

4.0±1.6 70

DOCUMENT ID

TECN

COMMENT

AUGUSTIN 89

DM2

 $e^+ e^-$

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

 $e^+ e^- \rightarrow 2(\pi^+ \pi^-) \pi^0$ Γ_{25}/Γ

NODE=M070R28

NODE=M070R28

 $\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL%

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

<5 90

DOCUMENT ID

TECN

COMMENT

VANNUCCI 77

MRK1

 $e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^-$ Γ_{26}/Γ

NODE=M070R46

NODE=M070R46

 $\Gamma(K^*(892)^\pm K^*(892)^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.00±0.19^{+0.11}_{-0.32}**

323

DOCUMENT ID

TECN

COMMENT

ABLIKIM

10E

BES2

 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$ Γ_{27}/Γ

NODE=M070S73

NODE=M070S73

 $\Gamma(K^*(892)^\pm K^*(700)^\mp)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) EVTS**1.09±0.18^{+0.94}_{-0.54}**

655

DOCUMENT ID

TECN

COMMENT

ABLIKIM

10E

BES2

 $J/\psi \rightarrow K^\pm K_S^0 \pi^\mp \pi^0$ Γ_{28}/Γ

NODE=M070S74

NODE=M070S74

 $\Gamma(\eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ 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_{35}/Γ

NODE=M070S69

NODE=M070S69

 $\Gamma(K^*(1410) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$

VALUE (%) EVTS

2.3±1.1±0.7

2k

DOCUMENT ID

TECN

COMMENT

¹ LEES

17C

BABR

 $J/\psi \rightarrow K^+ K^- \pi^0$ ¹ From a Dalitz plot analysis in an isobar model. Γ_{41}/Γ_{156}

NODE=M070P28

NODE=M070P28

NODE=M070P28;LINKAGE=A

 $\Gamma(K^*(1410) \bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp)/\Gamma(K_S^0 K^\pm \pi^\mp)$

VALUE (%) EVTS

1.5±0.5±0.9

4k

DOCUMENT ID

TECN

COMMENT

¹ LEES

17C

BABR

 $J/\psi \rightarrow K_S^0 K^\pm \pi^\mp$ ¹ From a Dalitz plot analysis in an isobar model. Γ_{42}/Γ_{157}

NODE=M070P32

NODE=M070P32

NODE=M070P32;LINKAGE=A

 $\Gamma(K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow K^\pm K^\mp \pi^0)/\Gamma(K^+ K^- \pi^0)$

VALUE (%) EVTS

3.5±1.3±0.9

2k

DOCUMENT ID

TECN

COMMENT

¹ LEES

17C

BABR

 $J/\psi \rightarrow K^+ K^- \pi^0$ ¹ From a Dalitz plot analysis in an isobar model. Γ_{44}/Γ_{156}

NODE=M070P29

NODE=M070P29

NODE=M070P29;LINKAGE=A

$$\Gamma(K_2^*(1430)\bar{K} + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp) / \Gamma(K_S^0 K^\pm \pi^\mp) \quad \Gamma_{45}/\Gamma_{157}$$

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
7.1 ± 1.3 ± 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

$$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{46}/\Gamma$$

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

$$\Gamma(\omega K^*(892)\bar{K} + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{50}/\Gamma$$

VALUE (units 10 ⁻⁴)	EVTs	DOCUMENT ID	TECN	COMMENT

61 ± 9 OUR AVERAGE

62.0 ± 6.8 ± 10.6	899 ± 98	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K_S^0 K^\pm \pi^\mp$
65.3 ± 10.2 ± 13.5	176 ± 28	ABLIKIM	08E BES2	$J/\psi \rightarrow \omega K^\mp K^- \pi^0$
53 ± 14 ± 14	530 ± 140	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S2
NODE=M070S2

OCCUR=2

$$\Gamma(\bar{K} K^*(892) + \text{c.c.} \rightarrow K_S^0 K^\pm \pi^\mp) / \Gamma(K_S^0 K^\pm \pi^\mp) \quad \Gamma_{52}/\Gamma_{157}$$

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

90.5 ± 0.9 ± 3.8 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=M070P30
NODE=M070P30

NODE=M070P30;LINKAGE=A

$$\Gamma(K^+ K^*(892)^- + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_{53}/\Gamma$$

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.

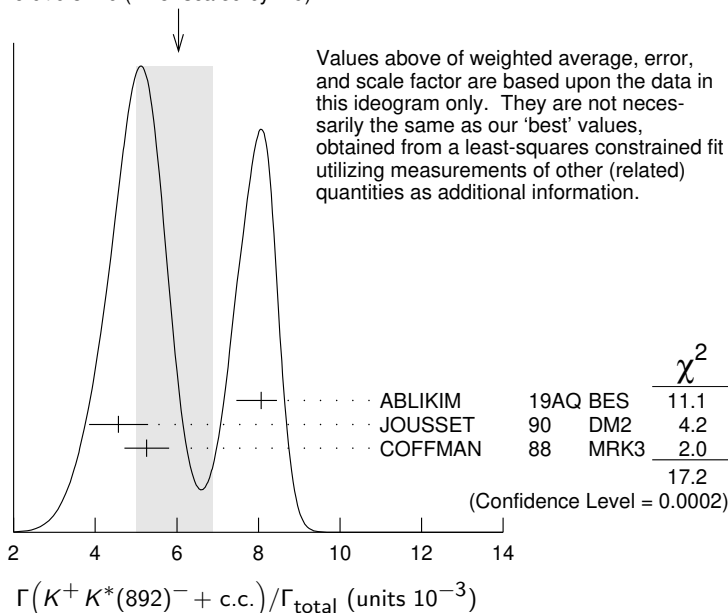
8.07 ± 0.04 ^{+0.38} _{-0.61}	183k	ABLIKIM	19AQ BES	$J/\psi \rightarrow K^+ K^- \pi^0$
4.57 ± 0.17 ± 0.70	2285	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
5.26 ± 0.13 ± 0.53		COFFMAN	88 MRK3	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp, K^+ K^- \pi^0$

• • • 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	$J/\psi \rightarrow K^\pm X$

NODE=M070S15
NODE=M070S15

WEIGHTED AVERAGE
6.0 ± 0.8 - 1.0 (Error scaled by 2.9)



$$\Gamma(K^+ K^*(892)^- + \text{c.c.} \rightarrow K^+ K^- \pi^0) / \Gamma(K^+ K^- \pi^0) \quad \Gamma_{54}/\Gamma_{156}$$

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT

92.4 ± 1.5 ± 3.4 2k ¹ LEES 17C BABR $J/\psi \rightarrow K^+ K^- \pi^0$

¹ From a Dalitz plot analysis in an isobar model.

NODE=M070P26
NODE=M070P26

NODE=M070P26;LINKAGE=A

$\Gamma(K^0 \bar{K}^*(892)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 $\pm$ 0.4 OUR AVERAGE				
3.96 $\pm$ 0.15 $\pm$ 0.60	1192	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
4.33 $\pm$ 0.12 $\pm$ 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 $\pm$ 0.6	45	VANNUCCI	77 MRK1	$J/\psi \rightarrow K^\pm K_S^0 \pi^\mp$

NODE=M070S16
 NODE=M070S16

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{58}/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

 $\Gamma(\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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

seen ¹ ABLIKIM 06C BES2 $J/\psi \rightarrow \bar{K}^*(892)^0 K^+ \pi^-$

¹ 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
 NODE=M070S52

NODE=M070S52;LINKAGE=AB

 $\Gamma(\omega \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.4 $\pm$ 0.3 $\pm$ 0.7	509	AUGUSTIN	89 DM2	$J/\psi \rightarrow \pi^+ \pi^- 3\pi^0$

NODE=M070S26
 NODE=M070S26

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
30 $\pm$ 5 OUR AVERAGE				
31 $\pm$ 6	4600	AUGUSTIN	89 DM2	$J/\psi \rightarrow 2(\pi^+ \pi^-) \pi^0$
29 $\pm$ 7	87	BURMESTER	77D PLUT	$e^+ e^-$

NODE=M070R49
 NODE=M070R49

 $\Gamma(\omega K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
34 $\pm$ 5 OUR AVERAGE				
37.7 $\pm$ 0.8 $\pm$ 5.8	1972 $\pm$ 41	ABLIKIM	08E BES2	$e^+ e^- \rightarrow J/\psi$
29.5 $\pm$ 1.4 $\pm$ 7.0	879 $\pm$ 41	BECKER	87 MRK3	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M070S1
 NODE=M070S1

 $\Gamma(b_1(1235)^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
23 $\pm$ 3 $\pm$ 5	229	AUGUSTIN	89 DM2	$e^+ e^-$

NODE=M070S28
 NODE=M070S28

 $\Gamma(\eta K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
21.8 $\pm$ 2.2 $\pm$ 3.4	232 $\pm$ 23	ABLIKIM	08E BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070S57
 NODE=M070S57

 $\Gamma(\eta' K^{*0} \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.66 $\pm$ 0.03 $\pm$ 0.21	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' K^* \bar{K}$

¹ From $\eta' K_S^0 K^\pm \pi^\mp$.

NODE=M070P49
 NODE=M070P49

NODE=M070P49;LINKAGE=A

 $\Gamma(\eta' K^{*\pm} K^\mp)/\Gamma_{\text{total}}$ Γ_{36}/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	$J/\psi \rightarrow \eta' K^* \bar{K}$

¹ From $\eta' K^+ K^- \pi^0$.² From $\eta' K_S^0 K^\pm \pi^\mp$.

NODE=M070P48
 NODE=M070P48

OCCUR=2

NODE=M070P48;LINKAGE=A

NODE=M070P48;LINKAGE=B

 $\Gamma(\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp)/\Gamma_{\text{total}}$ Γ_{39}/Γ

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

$$\Gamma(\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{38}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
2.16 ± 0.12 ± 0.29	1.1k	¹ ABLIKIM	18AB BES3	$J/\psi \rightarrow \eta' h_1 \rightarrow \eta' K^* \bar{K}$
¹ From $\eta' K_S^0 K^\pm \pi^\mp$.				

NODE=M070P52
NODE=M070P52

NODE=M070P52;LINKAGE=A

$$\Gamma(\phi K^*(892) \bar{K} + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{68}/\Gamma$$

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

$$\Gamma(\omega K \bar{K})/\Gamma_{\text{total}} \quad \Gamma_{69}/\Gamma$$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
19 ± 4 OUR AVERAGE				
19.8 ± 2.1 ± 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

$$\Gamma(\omega f_0(1710) \rightarrow \omega K \bar{K})/\Gamma_{\text{total}} \quad \Gamma_{70}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.8 ± 1.1 ± 0.3	^{1,2} FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070S25
NODE=M070S25

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;LINKAGE=F
NODE=M070S25;LINKAGE=G

$$\Gamma(\phi 2(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{71}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
16.0 ± 1.0 ± 3.0	FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

NODE=M070R35
NODE=M070R35

$$\Gamma(\Delta(1232)^{++} \bar{p} \pi^-)/\Gamma_{\text{total}} \quad \Gamma_{72}/\Gamma$$

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

$$\Gamma(\omega \eta)/\Gamma_{\text{total}} \quad \Gamma_{73}/\Gamma$$

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 ± 0.40 ± 0.14	13	² AUBERT	06D BABR	$10.6 e^+ e^- \rightarrow \omega \eta \gamma$
1.43 ± 0.10 ± 0.21	378	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
1.71 ± 0.08 ± 0.20		COFFMAN	88 MRK3	$e^+ e^- \rightarrow 3\pi \eta$

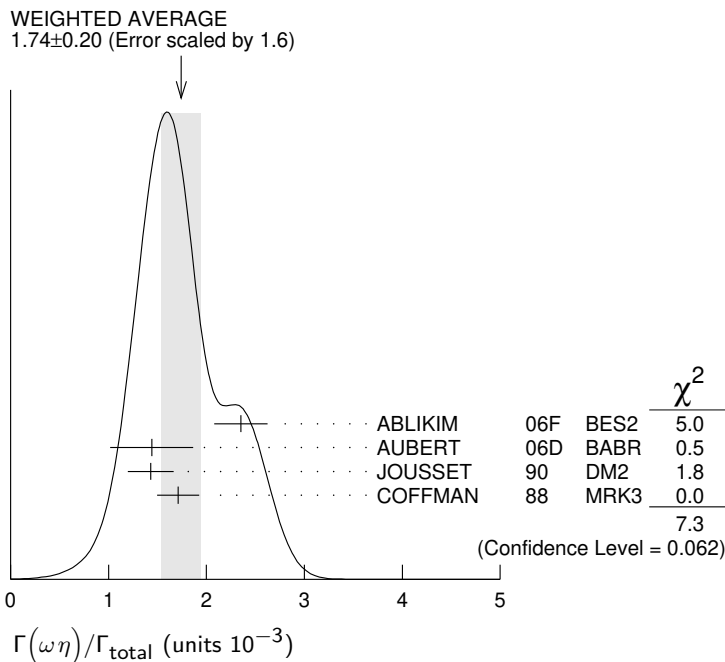
NODE=M070R30
NODE=M070R30

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 $\Gamma(J/\psi \rightarrow e^+ e^-) = 5.52 \pm 0.14 \pm 0.04 \text{ keV}$.

NODE=M070R30;LINKAGE=BL

NODE=M070R30;LINKAGE=EE



$\Gamma(\phi K \bar{K})/\Gamma_{\text{total}}$

Γ_{75}/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^-

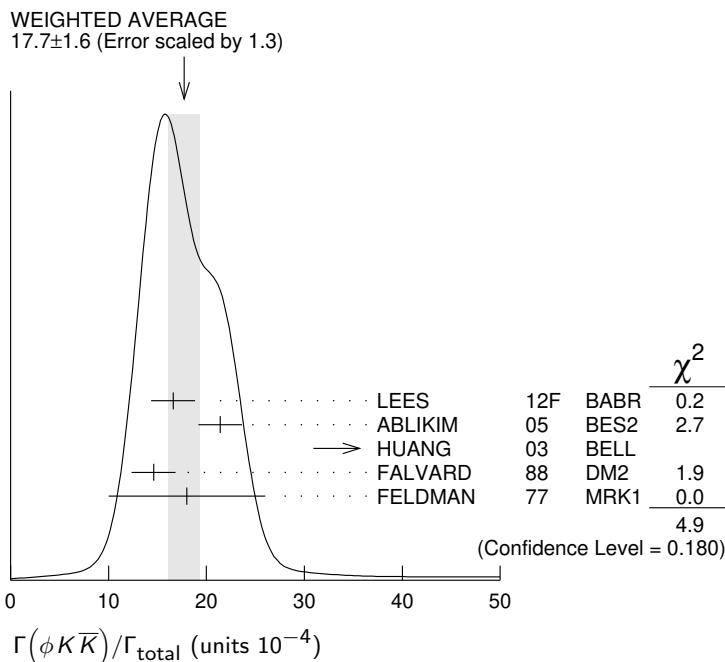
¹ We have multiplied K^+K^- measurement by 2 to obtain $K\bar{K}$.

² Using $B(B^+ \rightarrow J/\psi K^+) = (1.01 \pm 0.05) \times 10^{-3}$.

³ Addition of ϕK^+K^- and $\phi K^0\bar{K}^0$ branching ratios.

NODE=M070R36
NODE=M070R36

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_{77}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.6±0.2±0.6	1,2 FALVARD	88 DM2	$J/\psi \rightarrow \text{hadrons}$

¹ Including interference with $f'_2(1525)$.

² Includes unknown branching fraction $f_0(1710) \rightarrow K\bar{K}$.

NODE=M070S24
NODE=M070S24

NODE=M070S24;LINKAGE=D
NODE=M070S24;LINKAGE=E

$\Gamma(\phi f_2(1270))/\Gamma_{\text{total}}$ Γ_{79}/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

 $\Gamma(\Delta(1232)^{++}\bar{\Delta}(1232)^{--})/\Gamma_{\text{total}}$ Γ_{80}/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

 $\Gamma(\Sigma(1385)^-\bar{\Sigma}(1385)^+(\text{or c.c.}))/\Gamma_{\text{total}}$ Γ_{81}/Γ

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

1.16 ±0.05 OUR AVERAGE

1.096±0.012±0.071	43k	ABLIKIM	16L	BES3	$J/\psi \rightarrow \Sigma(1385)^-\bar{\Sigma}(1385)^+$
1.258±0.014±0.078	53k	ABLIKIM	16L	BES3	$J/\psi \rightarrow \Sigma(1385)^+\bar{\Sigma}(1385)^-$
1.23 ±0.07 ±0.30	0.8k	ABLIKIM	12P	BES2	$J/\psi \rightarrow \Sigma(1385)^-\bar{\Sigma}(1385)^+$
1.50 ±0.08 ±0.38	1k	ABLIKIM	12P	BES2	$J/\psi \rightarrow \Sigma(1385)^+\bar{\Sigma}(1385)^-$
1.00 ±0.04 ±0.21	0.6k	HENRARD	87	DM2	$e^+e^- \rightarrow \Sigma^{*-}$
1.19 ±0.04 ±0.25	0.7k	HENRARD	87	DM2	$e^+e^- \rightarrow \Sigma^{*+}$
0.86 ±0.18 ±0.22	56	EATON	84	MRK2	$e^+e^- \rightarrow \Sigma^{*-}$
1.03 ±0.24 ±0.25	68	EATON	84	MRK2	$e^+e^- \rightarrow \Sigma^{*+}$

NODE=M070R67
NODE=M070R67

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

 $\Gamma(\Sigma(1385)^0\bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$ Γ_{82}/Γ

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

1.071±0.009±0.082	103k	ABLIKIM	17E	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

NODE=M070P17
NODE=M070P17

OCCUR=2

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{84}/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

 $\Gamma(\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

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

0.94±0.15 OUR AVERAGE Error includes scale factor of 1.7.

1.09±0.02±0.13		ABLIKIM	05	BES2	$J/\psi \rightarrow \phi\pi^+\pi^-$
0.78±0.03±0.12		FALVARD	88	DM2	$J/\psi \rightarrow \text{hadrons}$
2.1 ±0.9	23	FELDMAN	77	MRK1	e^+e^-

NODE=M070R34
NODE=M070R34

 $\Gamma(\phi K^\pm K_S^0 \pi^\mp)/\Gamma_{\text{total}}$ Γ_{87}/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

 $\Gamma(\omega f_1(1420))/\Gamma_{\text{total}}$ Γ_{88}/Γ

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

6.8^{+1.9}_{-1.6}±1.7	111 ⁺³¹ ₋₂₆	BECKER	87	MRK3	$e^+e^- \rightarrow \text{hadrons}$

NODE=M070S5
NODE=M070S5

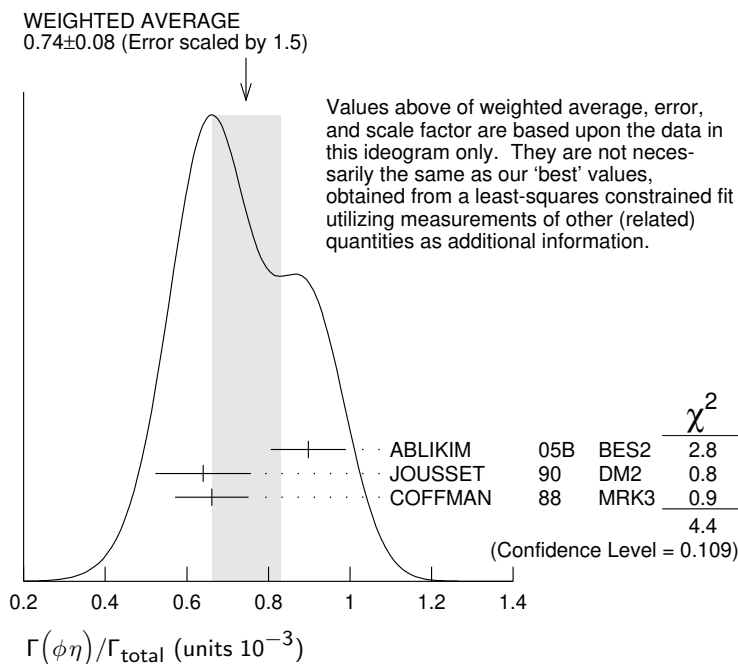
 $\Gamma(\phi\eta)/\Gamma_{\text{total}}$ Γ_{89}/Γ

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

0.74 ±0.08 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

0.898±0.024±0.089		ABLIKIM	05B	BES2	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadr}$
0.64 ±0.04 ±0.11	346	JOUSSET	90	DM2	$J/\psi \rightarrow \text{hadrons}$
0.661±0.045±0.078		COFFMAN	88	MRK3	$e^+e^- \rightarrow K^+K^-\eta$

NODE=M070R37
NODE=M070R37

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.32±0.06±0.16	2.2k	¹ ABLIKIM	19AN BES3	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$

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 $B(J/\psi \rightarrow \eta X) \times B(X \rightarrow \phi\eta') \approx 10^{-4}$.

 Γ_{99}/Γ

NODE=M070P85
NODE=M070P85

NODE=M070P85;LINKAGE=A

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

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	$e^+e^- \rightarrow J/\psi \rightarrow \text{hadrons}$
1.20 ±0.12 ±0.21	206	ABLIKIM	080 BES2	$e^+e^- \rightarrow J/\psi$

 Γ_{90}/Γ

NODE=M070S64
NODE=M070S64

 $\Gamma(\Xi(1530)^-\Xi^++\text{c.c.})/\Gamma_{\text{total}}$

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^-

 Γ_{91}/Γ

NODE=M070S9
NODE=M070S9

 $\Gamma(pK^-\bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.51±0.26±0.18	89	EATON	84 MRK2	e^+e^-

 Γ_{92}/Γ

NODE=M070R74
NODE=M070R74

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

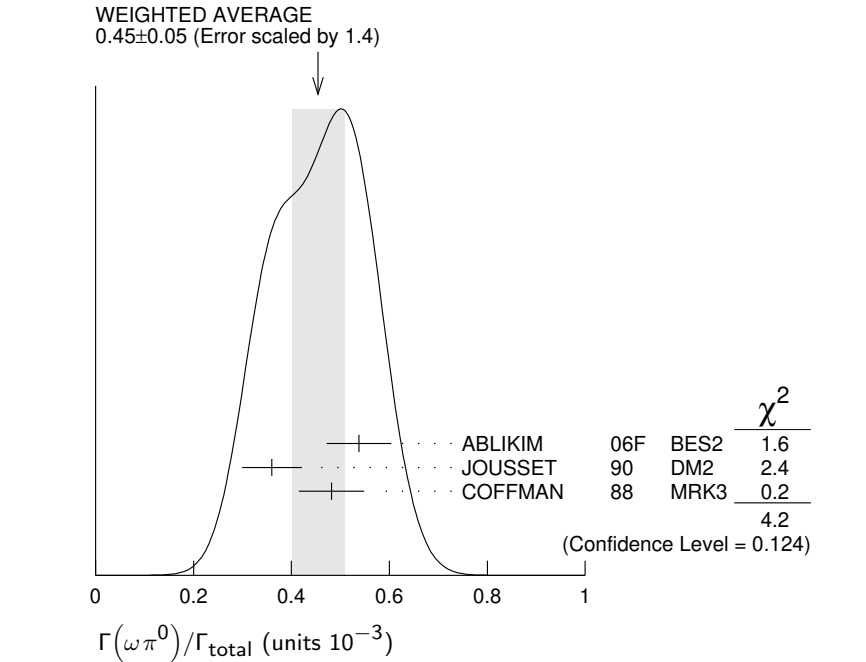
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.45 ±0.05 OUR AVERAGE				
0.538±0.012±0.065	2090	¹ ABLIKIM	06F BES2	$J/\psi \rightarrow \omega\pi^0$
0.360±0.028±0.054	222	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.482±0.019±0.064		COFFMAN	88 MRK3	$e^+e^- \rightarrow \pi^0\pi^+\pi^-\pi^0$

 Γ_{93}/Γ

NODE=M070R32
NODE=M070R32

¹ Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.1 \pm 0.7)\%$.

NODE=M070R32;LINKAGE=BL



$\Gamma(\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$					Γ_{94}/Γ_{141}
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT	
8±3±2	20k	¹ LEES	17C BABR	$J/\psi \rightarrow \pi^+\pi^-\pi^0$	

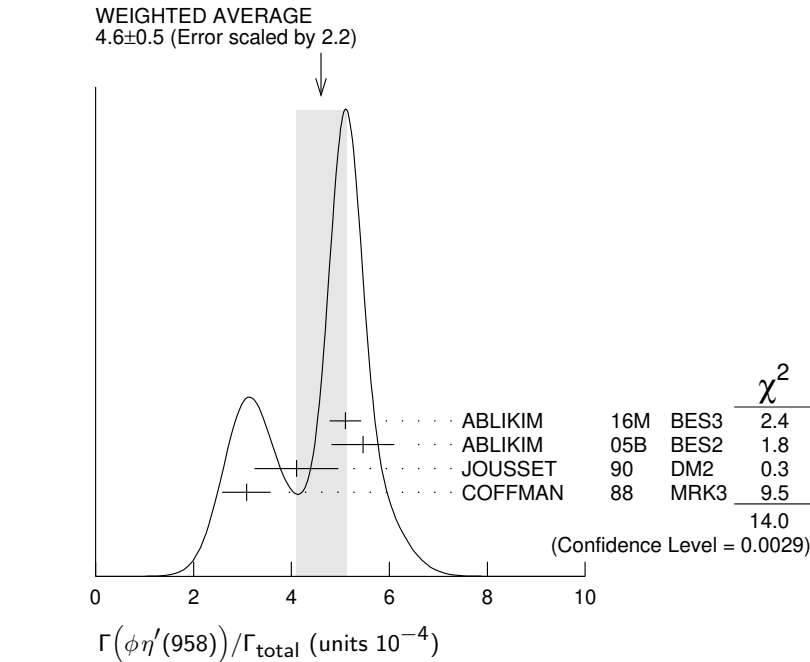
¹ From a Dalitz plot analysis in an isobar model and significance 4.9 σ .

NODE=M070P23
NODE=M070P23

NODE=M070P23;LINKAGE=A

$\Gamma(\phi\eta'(958))/\Gamma_{\text{total}}$					Γ_{95}/Γ
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^-	

NODE=M070R38
NODE=M070R38



$\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{96}/Γ

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	$J/\psi \rightarrow K^+ K^- K^+ K^-$

¹ Assuming $B(f_0(980) \rightarrow \pi\pi) = 0.78$.NODE=M070R41
NODE=M070R41

NODE=M070R41;LINKAGE=A

 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{100}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
4.50±0.80±0.61	355	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S97
NODE=M070S97 $\Gamma(\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\rho^0\pi^0)/\Gamma_{\text{total}}$ Γ_{101}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT
1.67±0.50±0.24	70	ABLIKIM	15P BES3	$J/\psi \rightarrow K^+ K^- 3\pi$

NODE=M070S98
NODE=M070S98 $\Gamma(\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
3.23±0.75±0.73	52	ABLIKIM	08F BES	$J/\psi \rightarrow \eta\phi f_0(980)$

NODE=M070R08
NODE=M070R08 $\Gamma(\phi a_0(980)^0 \rightarrow \phi\eta\pi^0)/\Gamma_{\text{total}}$ Γ_{103}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
4.37±1.35	¹ 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

 $\Gamma(\Xi(1530)^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{104}/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 $\Gamma(\Sigma(1385)^- \bar{\Sigma}^+ (\text{or c.c.}))/\Gamma_{\text{total}}$ Γ_{105}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.31±0.05 OUR AVERAGE				
0.30±0.03±0.07	74 ± 8	HENRARD	87 DM2	$e^+ e^- \rightarrow \Sigma^{*-}$
0.34±0.04±0.07	77 ± 9	HENRARD	87 DM2	$e^+ e^- \rightarrow \Sigma^{*+}$
0.29±0.11±0.10	26	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^{*-}$
0.31±0.11±0.11	28	EATON	84 MRK2	$e^+ e^- \rightarrow \Sigma^{*+}$

NODE=M070R68
NODE=M070R68

OCCUR=2

OCCUR=2

 $\Gamma(\phi f_1(1285))/\Gamma_{\text{total}}$ Γ_{106}/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		$J/\psi \rightarrow \phi\eta\pi^+\pi^-$
0.6±0.2±0.1	16	BECKER 87 MRK3		$J/\psi \rightarrow \phi K \bar{K} \pi$

NODE=M070S6
NODE=M070S6

OCCUR=2

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;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_{107}/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 $\Gamma(\phi f_1(1285) \rightarrow \phi\pi^0 f_0(980) \rightarrow \phi\pi^0\rho^0\pi^0)/\Gamma_{\text{total}}$ Γ_{108}/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

$\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.78±0.68	471	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 $\Gamma(\text{total})$.

NODE=M070P81
NODE=M070P81

NODE=M070P81;LINKAGE=A

 $\Gamma(\eta\rho)/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.193±0.023 OUR AVERAGE				
0.194±0.017±0.029	299	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
0.193±0.013±0.029		COFFMAN	88 MRK3	$e^+e^- \rightarrow \pi^+\pi^-\eta$

NODE=M070R22
NODE=M070R22

 $\Gamma(\omega\eta'(958))/\Gamma_{\text{total}}$ Γ_{111}/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	$e^+e^- \rightarrow 3\pi\eta'$

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
NODE=M070R31

NODE=M070R31;LINKAGE=A
NODE=M070R31;LINKAGE=BL

 $\Gamma(\omega f_0(980))/\Gamma_{\text{total}}$ Γ_{112}/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

 $\Gamma(\rho\eta'(958))/\Gamma_{\text{total}}$ Γ_{113}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
8.1 ±0.8 OUR AVERAGE				Error includes scale factor of 1.6.
7.90±0.19±0.49	3476	¹ ABLIKIM	17AK BES3	$J/\psi \rightarrow \pi^+\pi^-\eta'$
8.3 ±3.0 ±1.2	19	JOUSSET	90 DM2	$J/\psi \rightarrow \text{hadrons}$
11.4 ±1.4 ±1.6		COFFMAN	88 MRK3	$J/\psi \rightarrow \pi^+\pi^-\eta'$

¹ From a partial wave analysis of the decay $J/\psi \rightarrow \pi^+\pi^-\eta'$.

NODE=M070R23
NODE=M070R23

NODE=M070R23;LINKAGE=A

 $\Gamma(a_2(1320)^\pm\pi^\mp)/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<43 × 10⁻⁴	90	BRAUNSCH...	76 DASP	e^+e^-

NODE=M070R42
NODE=M070R42

 $\Gamma(K\bar{K}_2^*(1430)+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{115}/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

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.0 × 10⁻³	90	¹ BAI	99C BES	e^+e^-

¹ Assuming $B(K_1(1270) \rightarrow K\rho) = 0.42 \pm 0.06$

NODE=M070S34
NODE=M070S34

NODE=M070S34;LINKAGE=M2

 $\Gamma(K_1(1270)K_S^0 \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{117}/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

 $\Gamma(K_2^*(1430)^0\bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<29 × 10⁻⁴	90	VANNUCCI	77 MRK1	$e^+e^- \rightarrow \pi^+\pi^-\bar{K}^+K^-$

NODE=M070R47
NODE=M070R47

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

The two different fit values of ABLIKIM 15K below have the same statistical significance of 6.4σ 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 ± 9	² ABLIKIM 15K	BES3	$e^+e^- \rightarrow J/\psi \rightarrow K^+K^-\gamma\gamma$

• • • 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.

 $\Gamma(\phi\eta(1405) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$2.01 \pm 0.58 \pm 0.82$		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 3.6σ significance.

² Includes unknown branching fraction $\eta(1405) \rightarrow \eta\pi\pi$.

 $\Gamma(\omega f'_2(1525))/\Gamma_{\text{total}}$

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 $B(f'_2(1525) \rightarrow K\bar{K}) = 0.713$.

 $\Gamma(\omega X(1835) \rightarrow \omega p\bar{p})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.9 \times 10^{-6}$	95	ABLIKIM 13P	BES3	$J/\psi \rightarrow \gamma\pi^0 p\bar{p}$

 $\Gamma(\omega X(1835), X \rightarrow \eta'\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
$<6.2 \times 10^{-5}$	¹ ABLIKIM 19AC	BES3	$J/\psi \rightarrow \omega\eta'\pi^+\pi^-$

¹ Using the decays $\omega \rightarrow \pi^+\pi^-\pi^0$ and $\eta' \rightarrow \eta\pi^+\pi^-$.

 $\Gamma(\phi X(1835) \rightarrow \phi p\bar{p})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-7}$	90	¹ ABLIKIM 16K	BES3	$J/\psi \rightarrow p\bar{p}K_S^0 K_L^0, p\bar{p}K^+K^-$

¹ Upper limit applies to any $p\bar{p}$ mass enhancement near threshold.

 $\Gamma(\phi X(1835) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-4}$	90	ABLIKIM 15H	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$

 $\Gamma(\phi X(1870) \rightarrow \phi\eta\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.13 \times 10^{-5}$	90	ABLIKIM 15H	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$

 $\Gamma(\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.20 \pm 0.14 \pm 0.37$	471	ABLIKIM 15H	BES3	$e^+e^- \rightarrow J/\psi \rightarrow \phi\eta\pi^+\pi^-$

 $\Gamma(\eta\phi(2170) \rightarrow \eta K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.52 \times 10^{-4}$	90	ABLIKIM 10C	BES2	$J/\psi \rightarrow \eta K^+\pi^- K^-\pi^+$

 Γ_{120}/Γ

NODE=M070R33

NODE=M070R33

NODE=M070R33

OCCUR=2

NODE=M070R33;LINKAGE=A

NODE=M070R33;LINKAGE=C

NODE=M070R33;LINKAGE=B

 Γ_{121}/Γ

NODE=M070S23

NODE=M070S23

 Γ_{122}/Γ

NODE=M070R29

NODE=M070R29

 Γ_{123}/Γ

NODE=M070S81

NODE=M070S81

 Γ_{124}/Γ

NODE=M070P84

NODE=M070P84

 Γ_{125}/Γ

NODE=M070P00

NODE=M070P00

OCCUR=2

 Γ_{126}/Γ

NODE=M070B10

NODE=M070B10

 Γ_{127}/Γ

NODE=M070B11

NODE=M070B11

 Γ_{128}/Γ

NODE=M070B12

NODE=M070B12

 Γ_{129}/Γ

NODE=M070S70

NODE=M070S70

$\Gamma(\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{130}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.82 \times 10^{-5}$	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. • • •				
$<0.2 \times 10^{-3}$	90	HENRARD	87	DM2 $e^+ e^-$

NODE=M070S13
NODE=M070S13

 $\Gamma(\Delta(1232)^+ \bar{p})/\Gamma_{\text{total}}$
 Γ_{131}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.1 \times 10^{-3}$	90	HENRARD	87	DM2 $e^+ e^-$

NODE=M070S14
NODE=M070S14

 $\Gamma(\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda})/\Gamma_{\text{total}}$
 Γ_{132}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.1 \times 10^{-6}$	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_{133}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.80 \times 10^{-3}$	90	LU	19	BELL $B^+ \rightarrow \bar{p} \Lambda K^+ K^+$

NODE=M070P60
NODE=M070P60

 $\Gamma(\Theta(1540) \bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{134}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.1 \times 10^{-5}$	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_{135}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.1 \times 10^{-5}$	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_{136}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.6 \times 10^{-5}$	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_{137}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.6 \times 10^{-5}$	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_{138}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.1 \times 10^{-5}$	90	BAI	04G	BES2 $e^+ e^-$

NODE=M070S51
NODE=M070S51

STABLE HADRONS

 $\Gamma(2(\pi^+ \pi^-) \pi^0)/\Gamma_{\text{total}}$
 Γ_{139}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.73±0.32 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
4.73±0.44	228k	¹ 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 $e^+ e^- \rightarrow \text{hadrons}$
3.64±0.52	1500	BURMESTER	77D	PLUT $e^+ e^-$
4 ±1	675	JEAN-MARIE	76	MRK1 $e^+ e^-$

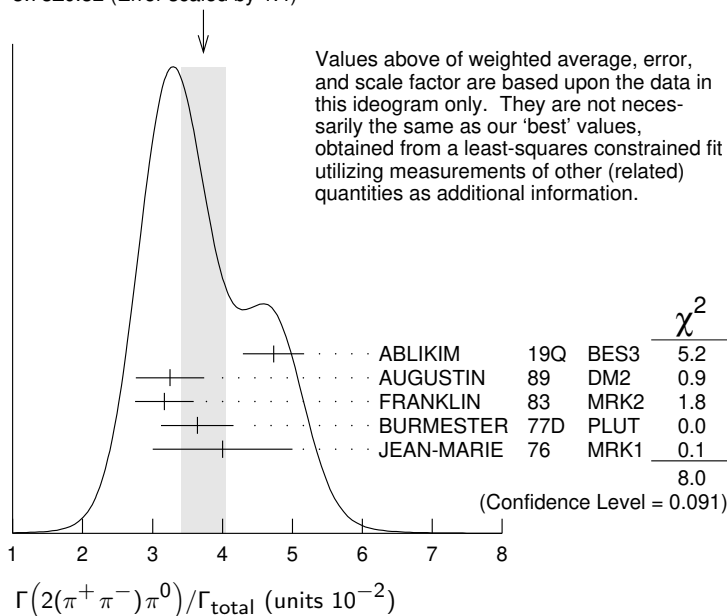
NODE=M070307

NODE=M070R9
NODE=M070R9

¹ 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=A

WEIGHTED AVERAGE
3.73±0.32 (Error scaled by 1.4)



$\Gamma(3(\pi^+\pi^-\pi^0))/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_{140}/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_{141}/Γ
21.0 ±0.8 OUR AVERAGE		Error includes scale factor of 1.6. See the ideogram below.			
21.37±0.04 ^{+0.64} _{-0.62}	1.8M	1,2 ABLIKIM	12H	BES3 $e^+e^- \rightarrow J/\psi$	
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	1,4 BAI	04H	BES e^+e^-	
20.91±0.21±1.16		4,5 BAI	04H	BES e^+e^-	
15 ±2	168	FRANKLIN	83	MRK2 e^+e^-	

NODE=M070R7
NODE=M070R7

OCCUR=2

¹ From $J/\psi \rightarrow \pi^+\pi^-\pi^0$ events directly.

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 $\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}} = 0.808 \pm 0.013$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ Mostly $\rho\pi$, see also $\rho\pi$ subsection.

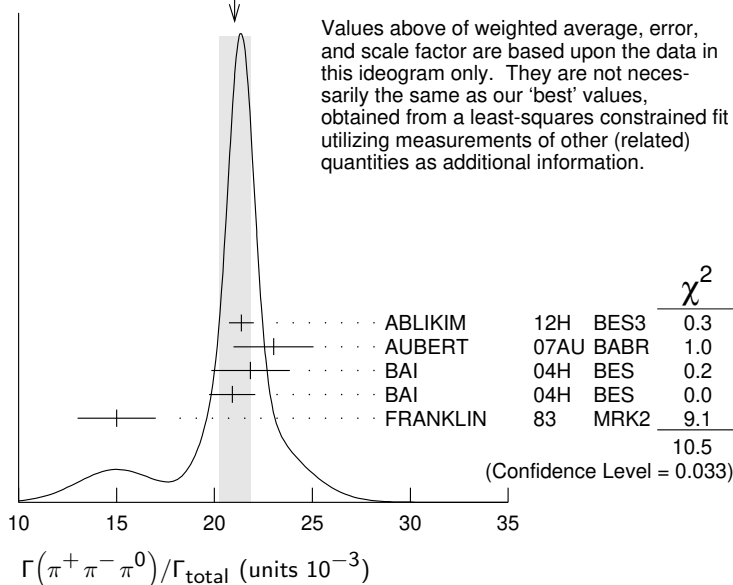
⁵ Obtained comparing the rates for $\pi^+\pi^-\pi^0$ and $\mu^+\mu^-$, using J/ψ events produced via $\psi(2S) \rightarrow \pi^+\pi^- J/\psi$ and with $B(J/\psi \rightarrow \mu^+\mu^-) = 5.88 \pm 0.10\%$.

NODE=M070R;LINKAGE=BA
NODE=M070R7;LINKAGE=AB

NODE=M070R7;LINKAGE=AU

NODE=M070R;LINKAGE=BU
NODE=M070R;LINKAGE=BI

WEIGHTED AVERAGE
21.0±0.8 (Error scaled by 1.6)



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

Γ_{145}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2±0.3	309	VANNUCCI	77	MRK1 e^+e^-

NODE=M070R18
NODE=M070R18

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

Γ_{146}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
90±30	13	JEAN-MARIE	76	MRK1 e^+e^-

NODE=M070R12
NODE=M070R12

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

Γ_{147}/Γ

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

NODE=M070R16
NODE=M070R16

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

7.2±2.3 205 VANNUCCI 77 MRK1 e^+e^-

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$

Γ_{155}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
61 ±10 OUR AVERAGE				
55.2±12.0	25	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_{156}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.88±0.01±0.12	183k	ABLIKIM	19AQ	BES $J/\psi \rightarrow K^+ K^- \pi^0$

NODE=M070P80
NODE=M070P80

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

$\Gamma_{156}/\Gamma_{141}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
12.0±0.3±0.9	23k	LEES	17C	BABR $J/\psi \rightarrow h^+ h^- \pi^0$

NODE=M070P34
NODE=M070P34

$\Gamma(K_S^0 K^\pm \pi^\mp)/\Gamma(\pi^+\pi^-\pi^0)$

$\Gamma_{157}/\Gamma_{141}$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
26.5±0.5±2.1	24k	LEES	17C	BABR $J/\psi \rightarrow h^0 h^+ h^-$

NODE=M070P35
NODE=M070P35

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

Γ_{162}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.57±0.30 OUR AVERAGE				

NODE=M070R8
NODE=M070R8

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^-

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_{163}/Γ

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

NODE=M070R10
NODE=M070R10

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

40±20	32	JEAN-MARIE	76	MRK1	e^+e^-

 $\Gamma(2(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{165}/Γ

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

NODE=M070S42
NODE=M070S42

2.26±0.08±0.27	4.8k	ABLIKIM	05C	BES2	$e^+e^- \rightarrow 2(\pi^+\pi^-)\eta$

 $\Gamma(3(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{166}/Γ

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

NODE=M070S43
NODE=M070S43

7.24±0.96±1.11	616	ABLIKIM	05C	BES2	$e^+e^- \rightarrow 3(\pi^+\pi^-)\eta$

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{169}/Γ

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

NODE=M070R50
NODE=M070R50

2.121±0.029 OUR AVERAGE

2.112±0.004±0.031	314k	ABLIKIM	12C	BES3	e^+e^-
2.20 ±0.16 ±0.06	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^-

¹WU 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 $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.004 \pm 0.027) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²Assuming angular distribution $(1+\cos^2\theta)$.

NODE=M070R50;LINKAGE=WU

NODE=M070R50;LINKAGE=A

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{170}/Γ

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

NODE=M070R52
NODE=M070R52

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^-

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{171}/Γ

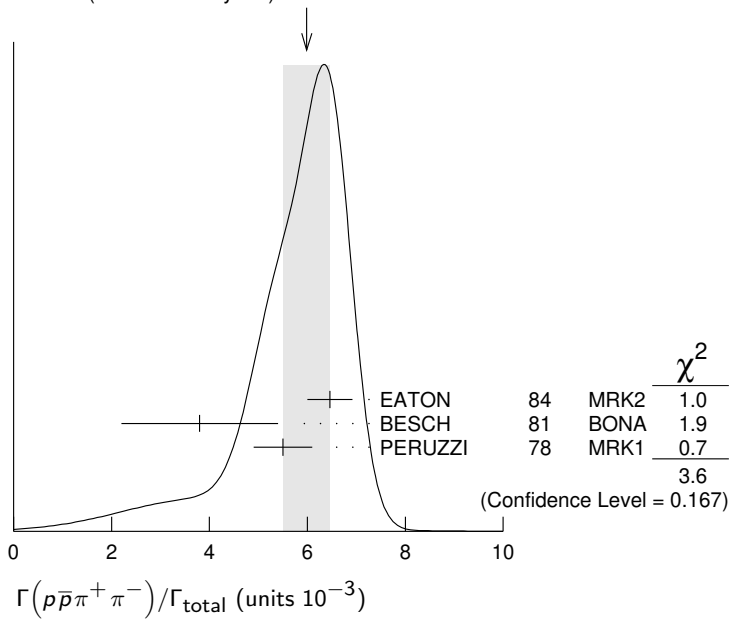
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M070R54
NODE=M070R54

6.0 ±0.5 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

6.46±0.17±0.43	1435	EATON	84	MRK2	e^+e^-
3.8 ±1.6	48	BESCH	81	BONA	e^+e^-
5.5 ±0.6	533	PERUZZI	78	MRK1	e^+e^-

WEIGHTED AVERAGE
 6.0 ± 0.5 (Error scaled by 1.3)



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

Γ_{172}/Γ

NODE=M070R55
 NODE=M070R55
 NODE=M070R55

Including $p\bar{p}\pi^+\pi^-\gamma$ and excluding ω, η, η'

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 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 ± 0.6	39	PERUZZI	78	MRK1 e^+e^-

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

Γ_{173}/Γ

NODE=M070R56
 NODE=M070R56

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.00 ± 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 ± 1.2		BRANDELIK	79C	DASP e^+e^-
2.3 ± 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_{174}/Γ

NODE=M070R57
 NODE=M070R57

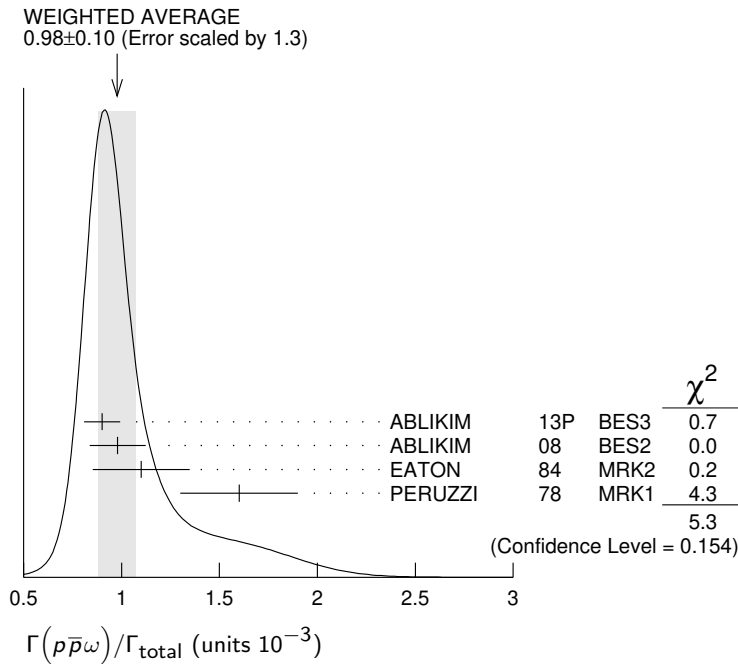
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 0.31 \times 10^{-3}$	90	EATON	84	MRK2 $e^+e^- \rightarrow \text{hadrons}\gamma$

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

Γ_{175}/Γ

NODE=M070R58
 NODE=M070R58

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.98 ± 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 ± 0.3	77	PERUZZI	78	MRK1 e^+e^-



$\Gamma(p\bar{p}\eta(958))/\Gamma_{\text{total}}$

Γ_{176}/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

$\Gamma(p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta)/\Gamma_{\text{total}}$

Γ_{177}/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_{178}/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

$\Gamma(n\bar{n})/\Gamma_{\text{total}}$

Γ_{179}/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

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

Γ_{180}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 3.6	5	BESCH	81 BONA	e^+e^-

NODE=M070R65
 NODE=M070R65

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

Γ_{181}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.50 ± 0.10 ± 0.22	399	ABLIKIM	080 BES2	$e^+e^- \rightarrow J/\psi$

NODE=M070S09
 NODE=M070S09

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{182}/Γ NODE=M070R63
NODE=M070R63

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.172±0.032 OUR AVERAGE Error includes scale factor of 1.4.				
1.164±0.004±0.023	111k	ABLIKIM	17L BES3	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.33 ±0.04 ±0.11	1.7k	ABLIKIM	06 BES2	$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.06 ±0.04 ±0.23	884	PALLIN	87 DM2	$e^+ e^- \rightarrow \Sigma^0 \bar{\Sigma}^0$
1.58 ±0.16 ±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	$e^+ e^- \rightarrow \Sigma^+ \bar{\Sigma}^-$

 $\Gamma(2(\pi^+ \pi^-) K^+ K^-)/\Gamma_{\text{total}}$ Γ_{183}/Γ NODE=M070R17
NODE=M070R17

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
31±13	30	VANNUCCI	77 MRK1	$e^+ e^-$

 $\Gamma(p \bar{n} \pi^-)/\Gamma_{\text{total}}$ Γ_{184}/Γ NODE=M070R53
NODE=M070R53

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	$e^+ e^- \rightarrow \bar{p} \pi^+$

OCCUR=2

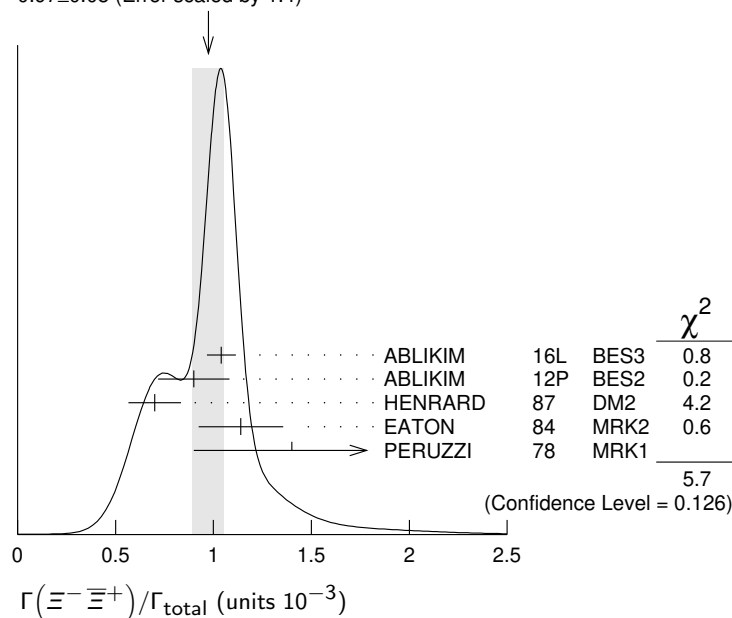
OCCUR=2

OCCUR=2

OCCUR=2

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{188}/Γ NODE=M070R62
NODE=M070R62

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±0.006±0.074	43k	ABLIKIM	16L BES3	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
0.90 ±0.03 ±0.18	961	ABLIKIM	12P BES2	$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$
0.70 ±0.06 ±0.12	132	HENRARD	87 DM2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.14 ±0.08 ±0.20	194	EATON	84 MRK2	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$
1.4 ±0.5	51	PERUZZI	78 MRK1	$e^+ e^- \rightarrow \Xi^- \bar{\Xi}^+$

WEIGHTED AVERAGE
0.97±0.08 (Error scaled by 1.4)

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{189}/Γ

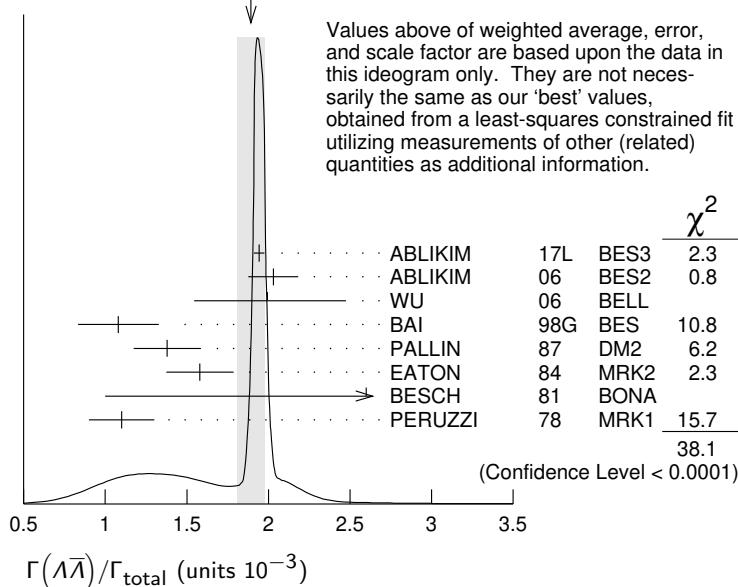
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.89 ± 0.09 OUR AVERAGE		Error includes scale factor of 2.8. See the ideogram below.		
1.943 $\pm 0.003 \pm 0.033$	441k	ABLIKIM	17L BES3	e^+e^-
2.03 $\pm 0.03 \pm 0.15$	8887	ABLIKIM	06 BES2	$J/\psi \rightarrow \Lambda\bar{\Lambda}$
2.0 $^{+0.5}_{-0.4} \pm 0.1$	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^-

NODE=M070R60
NODE=M070R60

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 $B(B^+ \rightarrow J/\psi(1S)K^+)$ = $(1.004 \pm 0.027) \times 10^{-3}$. 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
1.89 ± 0.09 (Error scaled by 2.8)

 $\Gamma(\Lambda\bar{\Sigma}^-\pi^+(\text{or c.c.}))/\Gamma_{\text{total}}$ Γ_{190}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.83 ± 0.07 OUR AVERAGE		Error includes scale factor of 1.2.		
0.770 $\pm 0.051 \pm 0.083$	335	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
0.747 $\pm 0.056 \pm 0.076$	254	¹ ABLIKIM	07H BES2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
0.90 $\pm 0.06 \pm 0.16$	225 ± 15	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.11 $\pm 0.06 \pm 0.20$	342 ± 18	HENRARD	87 DM2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$
1.53 $\pm 0.17 \pm 0.38$	135	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^+\pi^-$
1.38 $\pm 0.21 \pm 0.35$	118	EATON	84 MRK2	$e^+e^- \rightarrow \Lambda\bar{\Sigma}^-\pi^+$

NODE=M070R71
NODE=M070R71

OCCUR=2

OCCUR=2

OCCUR=2

¹Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\Sigma^+ \rightarrow \pi^0 p) = 51.6\%$.

NODE=M070R71;LINKAGE=AB

 $\Gamma(pK^-\bar{\Lambda}+\text{c.c.})/\Gamma_{\text{total}}$ Γ_{191}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.87 ± 0.11 OUR AVERAGE				
0.85 $^{+0.17}_{-0.15} \pm 0.02$	45	¹ LU	19 BELL	$B^+ \rightarrow \bar{p}\Lambda K^+ K^+$
0.89 $\pm 0.07 \pm 0.14$	307	EATON	84 MRK2	e^+e^-

NODE=M070R72
NODE=M070R72

¹LU 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 $B(B^+ \rightarrow J/\psi(1S)K^+) = (1.004 \pm 0.027) \times 10^{-3}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R72;LINKAGE=A

$\Gamma(2(K^+ K^-))/\Gamma_{\text{total}}$ Γ_{192}/Γ

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

• • • 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
NODE=M070R19

NODE=M070R19;LINKAGE=CC

 $\Gamma(p K^- \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{193}/Γ

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

$0.29 \pm 0.06 \pm 0.05$	90	EATON	84	MRK2 $e^+ e^-$

NODE=M070R73
NODE=M070R73

 $\Gamma(K^+ K^-)/\Gamma_{\text{total}}$ Γ_{194}/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	$e^+ e^-$

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
NODE=M070R13

NODE=M070R13;LINKAGE=ME
NODE=M070R13;LINKAGE=BA

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{195}/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	$e^+ e^-$

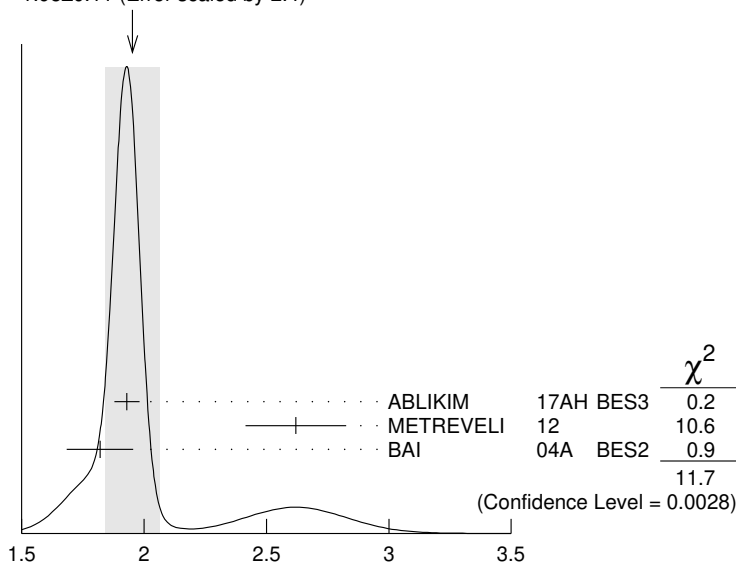
¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = 0.6868 \pm 0.0027$.

NODE=M070R75
NODE=M070R75

NODE=M070R75;LINKAGE=ME
NODE=M070R;LINKAGE=HZ

WEIGHTED AVERAGE
 1.95 ± 0.11 (Error scaled by 2.4)



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

 Γ_{195}/Γ $\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{196}/Γ

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

$4.30 \pm 0.13 \pm 0.99$	2.4k	ABLIKIM 12P	BES2	J/ψ

NODE=M070S78
NODE=M070S78

$\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$ Γ_{197}/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 $\Gamma(\Lambda\bar{\Lambda}\pi^0)/\Gamma_{\text{total}}$ Γ_{198}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.78±0.27±0.30		323	¹ 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. • • •					
< 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^-

¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$.NODE=M070S11
NODE=M070S11NODE=M070S11;LINKAGE=AL
NODE=M070S11;LINKAGE=AB $\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{199}/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

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{200}/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^-

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.NODE=M070R6
NODE=M070R6

NODE=M070R6;LINKAGE=ME

 $\Gamma(\Lambda\bar{\Sigma} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{201}/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 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{202}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.4 × 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 × 10 ⁻⁶	95	¹ BAI	04D BES	e^+e^-
<5.2 × 10 ⁻⁶	90	¹ BALTRUSAIT..85C	MRK3	e^+e^-

¹ Forbidden by CP.NODE=M070R14
NODE=M070R14

NODE=M070R14;LINKAGE=C

NODE=M070310

————— RADIATIVE DECAYS —————

 $\Gamma(3\gamma)/\Gamma_{\text{total}}$ Γ_{203}/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

$\Gamma(4\gamma)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-6}$	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

 Γ_{204}/Γ

NODE=M070S06
 NODE=M070S06

 $\Gamma(5\gamma)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<15 \times 10^{-6}$	90	ADAMS	08	CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

 Γ_{205}/Γ

NODE=M070S07
 NODE=M070S07

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.15 ± 0.05	¹ ABLIKIM	15AE BES3	$J/\psi \rightarrow \gamma\pi^0\pi^0$

 Γ_{206}/Γ

NODE=M070B00
 NODE=M070B00

¹ The uncertainty is systematic as statistical is negligible.

NODE=M070B00;LINKAGE=A

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

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$21.4 \pm 1.8 \pm 2.5$	596	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

 Γ_{207}/Γ

NODE=M070P01
 NODE=M070P01

 $\Gamma(\gamma a_0(980)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.5 \times 10^{-6}$	95	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

 Γ_{208}/Γ

NODE=M070P02
 NODE=M070P02

 $\Gamma(\gamma a_2(1320)^0 \rightarrow \gamma\eta\pi^0)/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-6}$	95	ABLIKIM	16P	BES3 $J/\psi \rightarrow 5\gamma$

 Γ_{209}/Γ

NODE=M070P03
 NODE=M070P03

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

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.1 ± 0.4	ABLIKIM	18AA BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

 Γ_{210}/Γ

NODE=M070P73
 NODE=M070P73

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.4	OUR AVERAGE	Error includes scale factor of 1.5.		

 Γ_{211}/Γ

NODE=M070R85
 NODE=M070R85

$2.00 \pm 0.31 \pm 0.02$

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. • • •

seen

ANASHIN 14 KEDR $J/\psi \rightarrow \gamma\eta_c$

0.79 ± 0.20

273 ± 43

² AUBERT 06E BABR $B^\pm \rightarrow K^\pm X_{c\bar{c}}$

seen

16

BALTRUSAIT..84 MRK3 $J/\psi \rightarrow 2\phi\gamma$

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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Calculated by the authors using an average of $B(J/\psi \rightarrow \gamma\eta_c) \times B(\eta_c \rightarrow K\bar{K}\pi)$ from BALTRUSAITIS 86, BISELLO 91, BAI 04 and $B(\eta_c \rightarrow K\bar{K}\pi) = (8.5 \pm 1.8)\%$ from AUBERT 06E.

NODE=M070R85;LINKAGE=MI

NODE=M070R85;LINKAGE=AU

 $\Gamma(\gamma\eta_c(1S) \rightarrow 3\gamma)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.8^{+1.3}_{-1.0}$	OUR AVERAGE	Error includes scale factor of 1.1.		

 Γ_{212}/Γ

NODE=M070S08
 NODE=M070S08

$4.5 \pm 1.2 \pm 0.6$

33 ± 9

ABLIKIM 13I BES3 $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

$1.2^{+2.7}_{-1.1} \pm 0.3$

$1.2^{+2.8}_{-1.1}$

ADAMS 08 CLEO $\psi(2S) \rightarrow \pi^+ \pi^- J/\psi$

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$8.3 \pm 0.2 \pm 3.1$	¹ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$

 Γ_{213}/Γ

NODE=M070R99
 NODE=M070R99

¹ 4π mass less than 2.0 GeV.

NODE=M070R99;LINKAGE=M

$\Gamma(\gamma\eta\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**6.1 ± 1.0 OUR AVERAGE**5.85 $\pm 0.3 \pm 1.05$ 7.8 $\pm 1.2 \pm 2.4$ ¹ Broad enhancement at 1700 MeV.

DOCUMENT ID	TECN	COMMENT
¹ EDWARDS 83B CBAL		$J/\psi \rightarrow \eta\pi^+\pi^-$
¹ EDWARDS 83B CBAL		$J/\psi \rightarrow \eta 2\pi^0$

 Γ_{214}/Γ NODE=M070R96
NODE=M070R96

OCCUR=2

NODE=M070R96;LINKAGE=M

 $\Gamma(\gamma\eta_2(1870) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**6.2 $\pm 2.2 \pm 0.9$**

DOCUMENT ID	TECN	COMMENT
BAI 99 BES		$J/\psi \rightarrow \gamma\eta\pi^+\pi^-$

 Γ_{215}/Γ NODE=M070S37
NODE=M070S37 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma K \bar{K} \pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})**2.8 ± 0.6 OUR AVERAGE**1.66 $\pm 0.1 \pm 0.58$ 3.8 $\pm 0.3 \pm 0.6$ 4.0 $\pm 0.7 \pm 1.0$ 4.3 ± 1.7

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

1.78 $\pm 0.21 \pm 0.33$ 0.83 $\pm 0.13 \pm 0.18$ 0.66 $^{+0.17}_{-0.16} \pm 0.24$ 1.03 $^{+0.21}_{-0.18} \pm 0.26$ -0.18 -0.19

DOCUMENT ID	TECN	COMMENT
^{1,2} BAI 00D BES		$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
³ AUGUSTIN 90 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
³ EDWARDS 82E CBAL		$J/\psi \rightarrow K^+ K^- \pi^0 \gamma$
^{3,4} SCHARRE 80 MRK2		$e^+ e^-$
^{3,5,6} AUGUSTIN 92 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
^{3,7,8} AUGUSTIN 92 DM2		$J/\psi \rightarrow \gamma K \bar{K} \pi$
^{3,6,9} BAI 90C MRK3		$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$
^{3,8,10} BAI 90C MRK3		$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

 Γ_{216}/Γ NODE=M070R89
NODE=M070R89

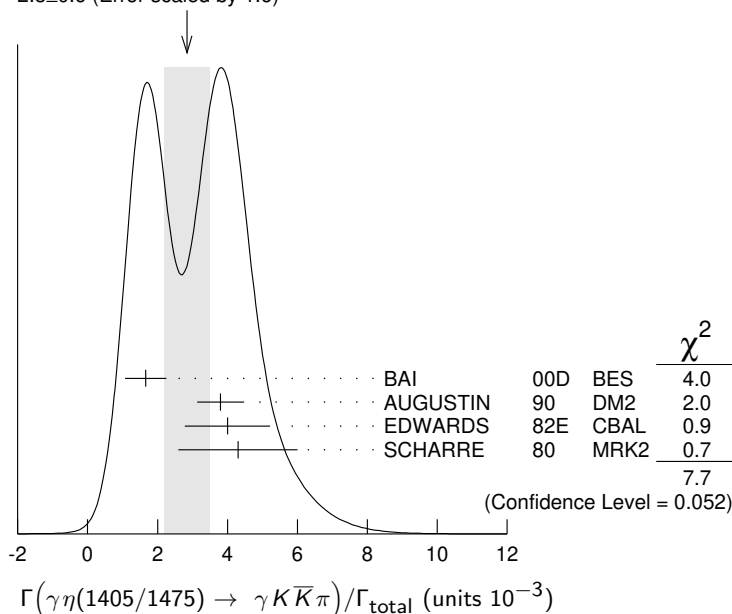
OCCUR=2

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) $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\rho^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})**0.78 ± 0.20 OUR AVERAGE**1.07 $\pm 0.17 \pm 0.11$ 0.64 $\pm 0.12 \pm 0.07$ ¹ Includes unknown branching fraction $\eta(1405) \rightarrow \gamma\rho^0$.

DOCUMENT ID	TECN	COMMENT
¹ BAI 04J BES2		$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$
¹ COFFMAN 90 MRK3		$J/\psi \rightarrow \gamma\gamma\pi^+\pi^-$

 Γ_{217}/Γ NODE=M070S30
NODE=M070S30

NODE=M070S30;LINKAGE=C

$\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{218}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0 $\pm$ 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

 $\Gamma(\gamma\eta(1405/1475) \rightarrow \gamma\gamma\phi)/\Gamma_{\text{total}}$ Γ_{219}/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_{220}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.63 $\times 10^{-6}$	90	ABLIKIM	180	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_{221}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.86 $\times 10^{-6}$	90	ABLIKIM	180	BES3 $\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M070P39
NODE=M070P39

 $\Gamma(\gamma\rho\rho)/\Gamma_{\text{total}}$ Γ_{222}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
4.5 $\pm$ 0.8 OUR AVERAGE				
4.7 $\pm$ 0.3 $\pm$ 0.9		¹ BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
3.75 $\pm$ 1.05 $\pm$ 1.20		² BURKE	82	MRK2 $J/\psi \rightarrow 4\pi\gamma$
• • • 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.

NODE=M070R94
NODE=M070R94

NODE=M070R94;LINKAGE=N
NODE=M070R94;LINKAGE=M
NODE=M070R94;LINKAGE=A

 $\Gamma(\gamma\rho\omega)/\Gamma_{\text{total}}$ Γ_{223}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<5.4 $\times 10^{-4}$	90	ABLIKIM	08A	BES2 $e^+e^- \rightarrow J/\psi$

NODE=M070R05
NODE=M070R05

 $\Gamma(\gamma\rho\phi)/\Gamma_{\text{total}}$ Γ_{224}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.8 $\times 10^{-5}$	90	ABLIKIM	08A	BES2 $e^+e^- \rightarrow J/\psi$

NODE=M070R06
NODE=M070R06

 $\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{225}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.25 $\pm$ 0.07 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
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	180	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

OCCUR=2

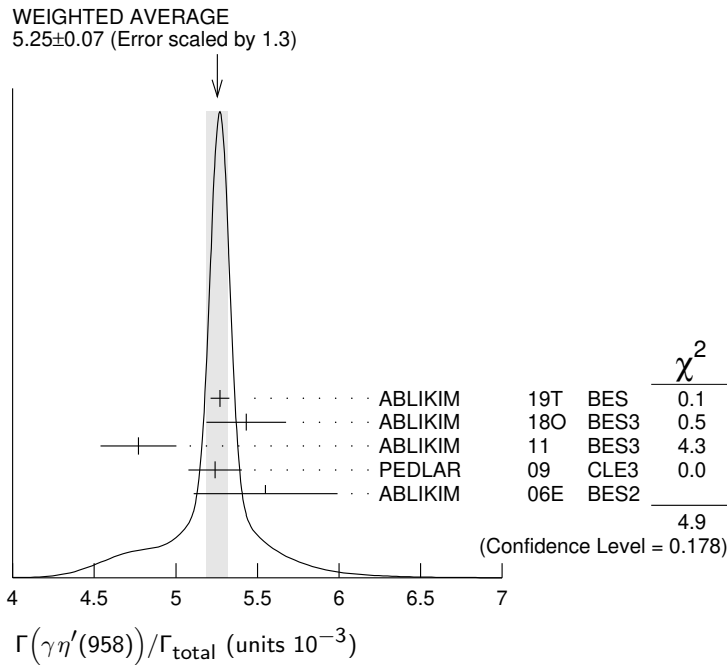
OCCUR=2

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 $B(\eta'(958) \rightarrow \gamma \gamma) = (2.307 \pm 0.033) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

² ABLIKIM 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 $B(\eta'(958) \rightarrow \pi^+ \pi^- \eta) = (42.5 \pm 0.5) \times 10^{-2}$, $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

NODE=M070R84;LINKAGE=AB



$\Gamma(\gamma 2\pi^+ 2\pi^-)/\Gamma_{\text{total}}$ Γ_{226}/Γ

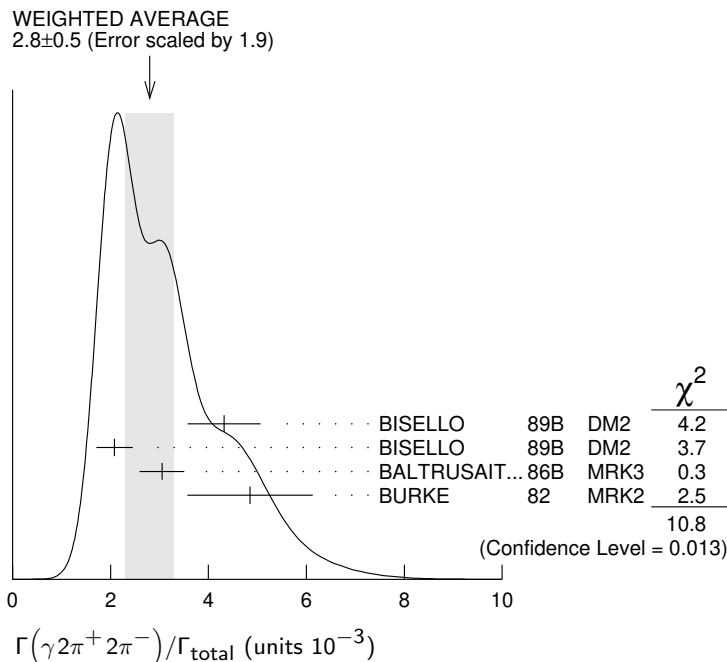
VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.8 ±0.5 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.		
4.32±0.14±0.73	¹ BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
2.08±0.13±0.35	² BISELLO	89B DM2	$J/\psi \rightarrow 4\pi\gamma$
3.05±0.08±0.45	² BALTRUSAIT..86B	MRK3	$J/\psi \rightarrow 4\pi\gamma$
4.85±0.45±1.20	³ BURKE	82 MRK2	e^+e^-

- ¹ 4π mass less than 3.0 GeV.
- ² 4π mass less than 2.0 GeV.
- ³ 4π 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_{227}/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_{228}/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

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

Γ_{229}/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

$\Gamma(\gamma f_4(2050))/\Gamma_{\text{total}}$

Γ_{230}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.7±0.5±0.5	¹ BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M070S7
NODE=M070S7

¹ Assuming branching fraction $f_4(2050) \rightarrow \pi\pi/\text{total} = 0.167$.

NODE=M070S7;LINKAGE=V

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

Γ_{231}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.61±0.33 OUR AVERAGE				
6.0 ±4.8 ±1.8		ABLIKIM	08A BES2	$J/\psi \rightarrow \gamma \omega \pi^+ \pi^-$
1.41±0.2 ±0.42	120 ± 17	BISELLO	87 SPEC	$e^+ e^-$, hadrons γ
1.76±0.09±0.45		BALTRUSAIT..85C	MRK3	$e^+ e^- \rightarrow \text{hadrons } \gamma$

NODE=M070R97
NODE=M070R97

$\Gamma(\gamma \eta(1405/1475) \rightarrow \gamma \rho^0 \rho^0)/\Gamma_{\text{total}}$

Γ_{232}/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	$J/\psi \rightarrow 4\pi \gamma$

NODE=M070S19
NODE=M070S19

¹ Estimated by us from various fits.

² Includes unknown branching fraction to $\rho^0 \rho^0$.

NODE=M070S19;LINKAGE=A
NODE=M070S19;LINKAGE=B

$\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$

Γ_{233}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.64±0.12 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			
2.07±0.16 ^{+0.02} _{-0.07}	2.4k	^{1,2} DOBBS	15	$J/\psi \rightarrow \gamma \pi \pi$
1.63±0.26 ^{+0.02} _{-0.06}		³ ABLIKIM	06V BES2	$e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^+ \pi^-$

NODE=M070R86
NODE=M070R86

$1.42 \pm 0.21^{+0.01}_{-0.05}$		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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R86;LINKAGE=A

NODE=M070R86;LINKAGE=DO

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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M070R86;LINKAGE=AI

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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

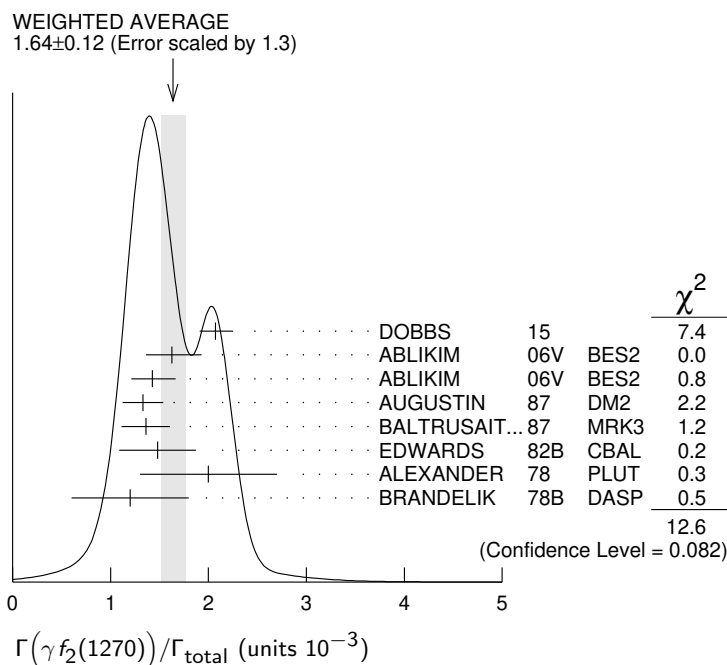
NODE=M070R86;LINKAGE=AL

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.

NODE=M070R86;LINKAGE=X

⁶ Restated by us to take account of spread of E1, M2, E3 transitions.

NODE=M070R86;LINKAGE=T



$\Gamma(\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{234}/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

$\Gamma(\gamma f_0(1370) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{235}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	COMMENT
$4.19 \pm 0.73 \pm 1.34$	478	¹ DOBBS 15	$J/\psi \rightarrow \gamma K \bar{K}$

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_{236}/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

$\Gamma(\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0) / \Gamma_{\text{total}}$ Γ_{237} / Γ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 $1.59 \pm 0.16^{+0.18}_{-0.56}$

ABLIKIM

18AA BES3

 $J/\psi \rightarrow \gamma K_S^0 K_S^0$ NODE=M070P64
NODE=M070P64 $\Gamma(\gamma f_0(1710) \rightarrow \gamma K \bar{K}) / \Gamma_{\text{total}}$ Γ_{238} / 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

NODE=M070R91
NODE=M070R91

below.

$8.00 \pm 0.12^{+1.24}_{-0.08-0.40}$	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	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=2

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

$1.6 \pm 0.2^{+0.6}_{-0.2}$	1.5	BAI	96C BES	$J/\psi \rightarrow \gamma K^+ K^-$
< 0.8	90	6	BISELLO	89B $J/\psi \rightarrow 4\pi\gamma$
$1.6 \pm 0.4 \pm 0.3$	7	BALTRUSAIT..87	MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^-$
3.8 ± 1.6	8	EDWARDS	82D CBAL	$e^+ e^- \rightarrow \eta \eta \gamma$

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 Assuming $J^P = 0^+$ for $f_0(1710)$.

⁶ Includes unknown branching fraction to $\rho^0 \rho^0$.

⁷ Includes unknown branching fraction to $\pi^+ \pi^-$.

⁸ Includes unknown branching fraction to $\eta \eta$.

NODE=M070R91;LINKAGE=B

NODE=M070R91;LINKAGE=D

NODE=M070R91;LINKAGE=K9

NODE=M070R91;LINKAGE=A1

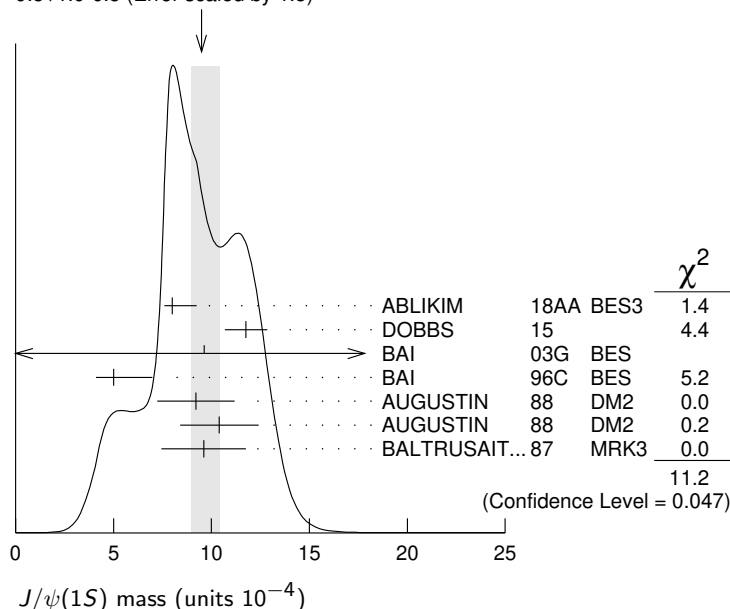
NODE=M070R91;LINKAGE=A2

NODE=M070R91;LINKAGE=C

NODE=M070R91;LINKAGE=Z

NODE=M070R91;LINKAGE=A

WEIGHTED AVERAGE
9.5+1.0-0.5 (Error scaled by 1.5)

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma \pi \pi) / \Gamma_{\text{total}}$ Γ_{239} / 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 $e^+ e^- \rightarrow J/\psi \rightarrow \gamma \pi^0 \pi^0$

NODE=M070B01
NODE=M070B01

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

$2.5 \pm 1.6 \pm 0.8$			BAI	98H BES $J/\psi \rightarrow \gamma \pi^0 \pi^0$

OCCUR=2

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

² Including unknown branching fraction to $\pi\pi$.

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \omega \omega) / \Gamma_{\text{total}}$

Γ_{240} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.31 \pm 0.06 \pm 0.08$	180	ABLIKIM	06H BES	$J/\psi \rightarrow \gamma \omega \omega$

NODE=M070B01;LINKAGE=A
NODE=M070B01;LINKAGE=AB

NODE=M070R01
NODE=M070R01

$\Gamma(\gamma f_0(1710) \rightarrow \gamma \eta \eta) / \Gamma_{\text{total}}$

Γ_{241} / 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	$J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S84
NODE=M070S84

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S84;LINKAGE=A

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

Γ_{242} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.108 ± 0.027 OUR AVERAGE				
$1.12 \pm 0.05 \pm 0.01$	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 ± 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 ± 0.10		BRANDELIK	79C DASP	$e^+ e^-$
1.3 ± 0.4	21	BARTEL	77 CNTR	$e^+ e^-$

NODE=M070R83
NODE=M070R83

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 $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R83;LINKAGE=A

$\Gamma(\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi) / \Gamma_{\text{total}}$

Γ_{243} / 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	$J/\psi \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

NODE=M070S31
NODE=M070S31

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

$\Gamma(\gamma f_1(1285)) / \Gamma_{\text{total}}$

Γ_{244} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.61 ± 0.08 OUR AVERAGE			
$0.69 \pm 0.16 \pm 0.20$	¹ BAI	04J BES2	$J/\psi \rightarrow \gamma \gamma \rho^0$
$0.61 \pm 0.04 \pm 0.21$	² BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$
$0.45 \pm 0.09 \pm 0.17$	³ BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$
$0.625 \pm 0.063 \pm 0.103$	⁴ BOLTON	92 MRK3	$J/\psi \rightarrow \gamma f_1(1285)$
$0.70 \pm 0.08 \pm 0.16$	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

$\Gamma(\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{245} / Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$4.5 \pm 1.0 \pm 0.7$	BAI	99 BES	$J/\psi \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M070S36
NODE=M070S36

$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{246}/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.

8.1 $\pm 0.9 \pm 0.2$	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	$J/\psi \rightarrow \gamma K^+ K^-$

OCCUR=3

OCCUR=4

OCCUR=2

• • • 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 $[\Gamma(J/\psi(15) \rightarrow \gamma f'_2(1525))/\Gamma_{\text{total}}] \times [B(f'_2(1525) \rightarrow K \bar{K})] = (7.09 \pm 0.46 \pm 0.67) \times 10^{-4}$ which we divide by our best value $B(f'_2(1525) \rightarrow K \bar{K}) = (87.6 \pm 2.2) \times 10^{-2}$. 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.

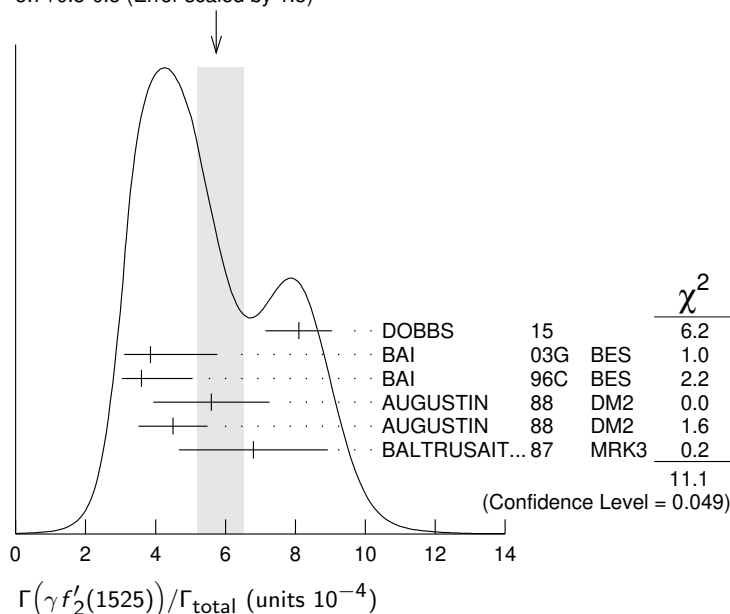
NODE=M070R87;LINKAGE=B

NODE=M070R87;LINKAGE=DO

NODE=M070R87;LINKAGE=A1

NODE=M070R87;LINKAGE=I

WEIGHTED AVERAGE
5.7+0.8-0.5 (Error scaled by 1.5)

 $\Gamma(\gamma f'_2(1525) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{247}/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_{248}/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 $J/\psi \rightarrow \gamma \eta \eta$

NODE=M070S86

NODE=M070S86

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S86;LINKAGE=A

 $\Gamma(\gamma f_2(1640) \rightarrow \gamma \omega \omega)/\Gamma_{\text{total}}$ Γ_{249}/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

 $\Gamma(\gamma f_2(1910) \rightarrow \gamma \omega \omega)/\Gamma_{\text{total}}$ Γ_{250}/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

$\Gamma(\gamma f_0(1750) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{251}/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 $\Gamma(\gamma f_0(1800) \rightarrow \gamma \omega \phi)/\Gamma_{\text{total}}$ Γ_{252}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 2.5 ± 0.6 OUR AVERAGE $2.00 \pm 0.08^{+1.38}_{-1.64}$

1.3k

ABLIKIM

13J

BES3

 $J/\psi \rightarrow \gamma \omega \phi$ $2.61 \pm 0.27 \pm 0.65$

95

ABLIKIM

06J

BES2

 $J/\psi \rightarrow \gamma \omega \phi$ NODE=M070S79
NODE=M070S79 $\Gamma(\gamma f_2(1810) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{253}/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

 $\Gamma(\gamma f_2(1950) \rightarrow \gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{254}/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 $\Gamma(\gamma K^*(892) \bar{K}^*(892))/\Gamma_{\text{total}}$ Γ_{255}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $4.0 \pm 0.3 \pm 1.3$

320

¹

BAI

00B

BES

 $J/\psi \rightarrow \gamma K^+ K^0 \pi^+ \pi^-$ NODE=M070B07
NODE=M070B07¹ Summed over all charges.

NODE=M070R;LINKAGE=B7

 $\Gamma(\gamma \phi \phi)/\Gamma_{\text{total}}$ Γ_{256}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 4.0 ± 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

 $J/\psi \rightarrow \gamma 4K$ $3.4 \pm 0.8 \pm 0.6$ 33 ± 7 ¹

BISELLO

90

DM2

 $J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$ $3.1 \pm 0.7 \pm 0.4$ ¹

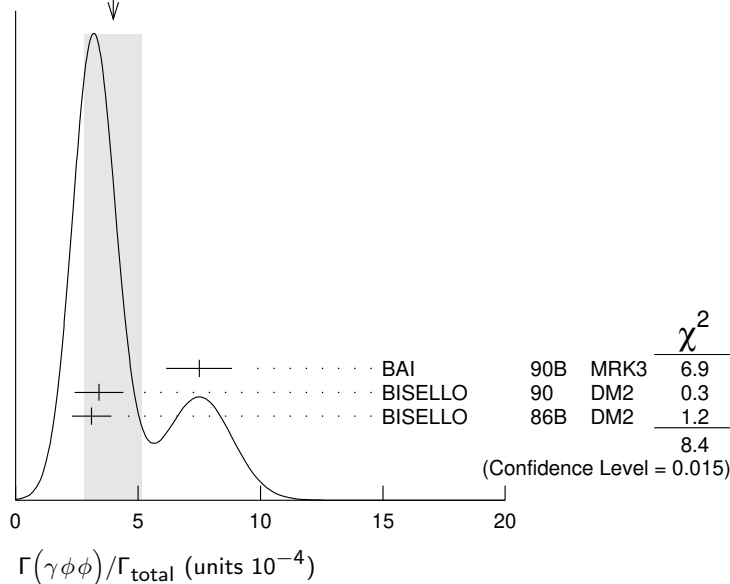
BISELLO

86B

DM2

 $J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$ NODE=M070R98
NODE=M070R98¹ $\phi \phi$ mass less than 2.9 GeV, η_c excluded.

NODE=M070R98;LINKAGE=C

WEIGHTED AVERAGE
 4.0 ± 1.2 (Error scaled by 2.1) $\Gamma(\gamma \rho \rho)/\Gamma_{\text{total}}$ Γ_{257}/Γ VALUE (units 10^{-3})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

 $0.38 \pm 0.07 \pm 0.07$

49

EATON

84

MRK2

 $e^+ e^-$ NODE=M070R90
NODE=M070R90

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

<0.11

90

PERUZZI

78

MRK1

 $e^+ e^-$

$\Gamma(\gamma\eta(2225))/\Gamma_{\text{total}}$ Γ_{258}/Γ

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

NODE=M070S21
NODE=M070S21

3.14^{+0.50}_{-0.19} OUR AVERAGE

2.40 ± 0.10 ^{+2.47} _{-0.18}	196	^{1,2} ABLIKIM	16N BES3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
4.4 ± 0.4 ± 0.8		² ABLIKIM	08I BES	$J/\psi \rightarrow \gamma K^+ K^- K_S^0 K_L^0$
3.3 ± 0.8 ± 0.5		² BAI	90B MRK3	$J/\psi \rightarrow \gamma K^+ K^- K^+ K^-$
2.7 ± 0.6 ± 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 $\eta(2100)$, 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

 $\Gamma(\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0)/\Gamma_{\text{total}}$ Γ_{259}/Γ

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

0.13 ± 0.09	^{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=M070S20
NODE=M070S20

NODE=M070S20;LINKAGE=A
NODE=M070S20;LINKAGE=B

 $\Gamma(\gamma\eta(1760) \rightarrow \gamma\omega\omega)/\Gamma_{\text{total}}$ Γ_{260}/Γ

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

1.98 ± 0.08 ± 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_{261}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

< 4.80 × 10⁻⁶	90	ABLIKIM	180 BES3	$\psi(2S) \rightarrow \pi^+\pi^-\gamma\gamma\gamma$

NODE=M070P40
NODE=M070P40

 $\Gamma(\gamma X(1835) \rightarrow \gamma\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{262}/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. $[(2.77^{+0.34}_{-0.40}) \times 10^{-4}]$
OUR 2020 AVERAGE Scale factor = 1.1]

NEW

3.93 ± 0.38 ^{+0.31} _{-0.84}		¹ ABLIKIM	16J BES3	$J/\psi \rightarrow \gamma\pi^+\pi^-\eta'$
2.2 ± 0.4 ± 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 ± 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.

NODE=M070R78;LINKAGE=A

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;LINKAGE=A

 $\Gamma(\gamma X(1835) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{263}/Γ

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

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 ± 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.

NODE=M070S71;LINKAGE=AK

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=AL

$\Gamma(\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta) / \Gamma_{\text{total}}$ Γ_{264} / Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
$3.31^{+0.33+1.96}_{-0.30-1.29}$	ABLIKIM	15T BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta$

NODE=M070S96
NODE=M070S96

 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \phi(1020)) / \Gamma_{\text{total}}$ Γ_{265} / Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

• • • 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	$J/\psi \rightarrow \gamma \gamma \phi(1020)$

NODE=M070P37
NODE=M070P37

OCCUR=2

NODE=M070P37;LINKAGE=A

NODE=M070P37;LINKAGE=B

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.

 $\Gamma(\gamma X(1835) \rightarrow \gamma \gamma \gamma) / \Gamma_{\text{total}}$ Γ_{266} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$< 3.56 \times 10^{-6}$	90	ABLIKIM	18O BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$

NODE=M070P41
NODE=M070P41

 $\Gamma(\gamma X(1840) \rightarrow \gamma 3(\pi^+ \pi^-)) / \Gamma_{\text{total}}$ Γ_{269} / Γ

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

$2.44 \pm 0.36^{+0.60}_{-0.74}$	0.6k	ABLIKIM	13U BES3	$J/\psi \rightarrow \gamma 3(\pi^+ \pi^-)$

NODE=M070S82
NODE=M070S82

 $\Gamma(\gamma X(2370) \rightarrow \gamma K^+ K^- \eta') / \Gamma_{\text{total}}$ Γ_{267} / Γ

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

$1.79 \pm 0.23 \pm 0.65$	ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K^+ K^- \eta'$

NODE=M070P86
NODE=M070P86

 $\Gamma(\gamma X(2370) \rightarrow \gamma K_S^0 K_S^0 \eta') / \Gamma_{\text{total}}$ Γ_{268} / Γ

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

$1.18 \pm 0.32 \pm 0.39$	ABLIKIM	20Q BES3	$J/\psi \rightarrow \gamma K_S^0 K_S^0 \eta'$

NODE=M070P87
NODE=M070P87

 $\Gamma(\gamma(K \bar{K} \pi) [J^{PC} = 0^{-+}]) / \Gamma_{\text{total}}$ Γ_{270} / Γ

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

0.7 ± 0.4 OUR AVERAGE Error includes scale factor of 2.1.

$0.58 \pm 0.03 \pm 0.20$	¹ BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

$2.1 \pm 0.1 \pm 0.7$	² BAI	00D BES	$J/\psi \rightarrow \gamma K^\pm K_S^0 \pi^\mp$

NODE=M070S38
NODE=M070S38

OCCUR=2

NODE=M070S38;LINKAGE=BD
NODE=M070S38;LINKAGE=BE

¹ For a broad structure around 1800 MeV.

² For a broad structure around 2040 MeV.

 $\Gamma(\gamma \pi^0) / \Gamma_{\text{total}}$ Γ_{271} / Γ

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

3.56 ± 0.17 OUR AVERAGE

$3.59 \pm 0.20 \pm 0.03$	1.6k	¹ ABLIKIM	18O BES3	$\psi(2S) \rightarrow \pi^+ \pi^- \gamma \gamma \gamma$

$3.63 \pm 0.36 \pm 0.13$		PEDLAR	09 CLE3	$J/\psi \rightarrow \pi^0 \gamma$

$3.13^{+0.65}_{-0.47}$	586	ABLIKIM	06E BES2	$J/\psi \rightarrow \pi^0 \gamma$

NODE=M070R82
NODE=M070R82

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

$3.6 \pm 1.1 \pm 0.7$		BLOOM	83 CBAL	$e^+ e^-$

7.3 ± 4.7	10	BRANDELIK	79C DASP	$e^+ e^-$

¹ ABLIKIM 180 reports $[\Gamma(J/\psi(1S) \rightarrow \gamma \pi^0) / \Gamma_{\text{total}}] \times [B(\pi^0 \rightarrow 2\gamma)] = (3.57 \pm 0.12 \pm 0.16) \times 10^{-5}$ from a measurement of $[\Gamma(J/\psi(1S) \rightarrow \gamma \pi^0) / \Gamma_{\text{total}}] \times [B(\pi^0 \rightarrow 2\gamma)] \times [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)]$ 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 $B(\pi^0 \rightarrow 2\gamma) = (98.823 \pm 0.034) \times 10^{-2}$, $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

NODE=M070R82;LINKAGE=A

 $\Gamma(\gamma p \bar{p} \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{272} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$< 0.79 \times 10^{-3}$	90	EATON	84 MRK2	$e^+ e^-$

NODE=M070R93
NODE=M070R93

$\Gamma(\gamma\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{273}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.13 \times 10^{-3}$	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^-

NODE=M070S8
 NODE=M070S8

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma\eta\eta)/\Gamma_{\text{total}}$ Γ_{274}/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	$J/\psi \rightarrow \gamma\eta\eta$

NODE=M070S85
 NODE=M070S85

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.

NODE=M070S85;LINKAGE=A

 $\Gamma(\gamma f_0(2100) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ Γ_{275}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.24 \pm 0.48 \pm 0.87$	744	¹ DOBBS	15	$J/\psi \rightarrow \gamma\pi\pi$

NODE=M070B08
 NODE=M070B08

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B08;LINKAGE=A

 $\Gamma(\gamma f_0(2200))/\Gamma_{\text{total}}$ Γ_{276}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.5	¹ AUGUSTIN	88 DM2	$J/\psi \rightarrow \gamma K_S^0 K_S^0$

NODE=M070S18
 NODE=M070S18

¹ Includes unknown branching fraction to $K_S^0 K_S^0$.

NODE=M070S18;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ Γ_{277}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	COMMENT
$5.86 \pm 0.49 \pm 1.20$	490	¹ DOBBS	15 $J/\psi \rightarrow \gamma K\bar{K}$

NODE=M070B09
 NODE=M070B09

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M070B09;LINKAGE=A

 $\Gamma(\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{278}/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

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{279}/Γ

VALUE (units 10^{-5})	CL%	EVTS	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_{280}/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=D0

$\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{281}/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	$e^+e^- \rightarrow J/\psi \rightarrow \gamma K_S^0 K_S^0$

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
NODE=M070B03

OCCUR=2

OCCUR=2

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_{282}/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_{283}/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 $\Gamma(\gamma f_2(2340) \rightarrow \gamma \eta \eta)/\Gamma_{\text{total}}$ Γ_{284}/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

 $\Gamma(\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{285}/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 $\Gamma(\gamma f_0(1500) \rightarrow \gamma \pi \pi)/\Gamma_{\text{total}}$ Γ_{286}/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. • • •				
5.7 ± 0.8		^{3,4} BUGG	95 MRK3	$J/\psi \rightarrow \gamma \pi^+ \pi^- \pi^+ \pi^-$

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
NODE=M070S32

OCCUR=2

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_{287}/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	$J/\psi \rightarrow \gamma \eta \eta$

¹ From partial wave analysis including all possible combinations of 0^{++} , 2^{++} , and 4^{++} resonances.NODE=M070S83
NODE=M070S83

NODE=M070S83;LINKAGE=A

 $\Gamma(\gamma A \rightarrow \gamma \text{invisible})/\Gamma_{\text{total}}$ Γ_{288}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$< 1.7 \times 10^{-6}$ (CL = 90%)					$[< 6.3 \times 10^{-6} \text{ (CL = 90\%)} \text{ OUR 2020 BEST LIMIT}]$
$< 1.7 \times 10^{-6}$	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 with mass $m_A < 1.2$ GeV. The limit varies with m_A , reaching its largest value of 1.7×10^{-6} at 1.2 GeV and being 7.0×10^{-7} for $m_A = 0$.² The limit varies with mass m_A of a narrow state A and is 4.3×10^{-6} for $m_A = 0$, reaches its largest value of 6.3×10^{-6} at $m_A = 500$ MeV, and is 3.6×10^{-6} at $m_A = 960$ 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_{289}/Γ
 (narrow state A^0 with $0.2 \text{ GeV} < m_{A^0} < 3 \text{ GeV}$)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<0.5 \times 10^{-5}$	90	¹ ABLIKIM	16E BES3	$J/\psi \rightarrow \gamma \mu^+ \mu^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<2.1 \times 10^{-5}$	90	² 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 GeV. The measured 90% CL limit as a function of m_{A^0} is in the range $(2.8\text{--}495.3) \times 10^{-8}$.

² 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=A

NODE=M070S76;LINKAGE=AB

NODE=M070330

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ Γ_{290}/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_{291}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.43 \pm 0.04 \pm 0.06$	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 $m(\Lambda) = 2.84 \pm 0.11 \pm 0.08$ 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_{292}/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

$\Gamma(\eta U \rightarrow \eta e^+ e^-)/\Gamma_{\text{total}}$ Γ_{293}/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_{294}/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_{295}/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_{296}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-5}$	90	ABLIKIM	06M BES2	$e^+ e^- \rightarrow J/\psi$

NODE=M070320

NODE=M070S53
 NODE=M070S53

$\Gamma(\bar{D}^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{297}/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_{298}/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_{299}/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_{300}/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_{301}/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_{302}/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_{303}/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_{304}/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_{305}/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	$e^+ e^-$

NODE=M070R80
NODE=M070R80

NODE=M070R80;LINKAGE=WI

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 $B(B^+ \rightarrow J/\psi(1S) K^+) = 1.004 \times 10^{-3}$.

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{306}/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_{307}/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

$\Gamma(e^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.3 \times 10^{-6}$	90	ABLIKIM	04 BES	$e^+e^- \rightarrow J/\psi$

 Γ_{308}/Γ

NODE=M070S40
 NODE=M070S40

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.9 \times 10^{-8}$	90	ABLIKIM	19AF BES3	$e^+e^- \rightarrow J/\psi \rightarrow pK^-\pi^+e^- (+ \text{c.c.})$

 Γ_{310}/Γ

NODE=M070P74
 NODE=M070P74

 $\Gamma(\mu^{\pm}\tau^{\mp})/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.0 \times 10^{-6}$	90	ABLIKIM	04 BES	$e^+e^- \rightarrow J/\psi$

 Γ_{309}/Γ

NODE=M070S41
 NODE=M070S41

OTHER DECAYS

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-2}$	90	LEES	13I BABR	$B \rightarrow K^{(*)}J/\psi$

 Γ_{311}/Γ_5

NODE=M070S80
 NODE=M070S80

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-2}$	90	ABLIKIM	08G BES2	$\psi(2S) \rightarrow \pi^+\pi^-J/\psi$

 Γ_{311}/Γ_7

NODE=M070S60
 NODE=M070S60

 $J/\psi(1S)$ REFERENCES

NODE=M070

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
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	Ablikim M. <i>et al.</i>	(BESIII Collab.)	REFID=55300
ABLIKIM	13N	PR D87 092009	Ablikim M. <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
BESSION	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 (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
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	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	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51059
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	04	PL B578 16	J.Z. Bai <i>et al.</i>	(BES Collab.)	REFID=49620
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 D760 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
BISELLO	91	NP B350 1	D. Bisello <i>et al.</i>	(DM2 Collab.)	REFID=41668
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
HENRARD	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...	86	PR D33 629	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)	REFID=22009
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	PR D34 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
Translated from YAF 41 733					
BALTRUSAIT...	84	PRL 52 2126	R.M. Baltrusaitis <i>et al.</i>	(CIT, UCSC+)	REFID=22006
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					
EDWARDS	82E	ARNS 33 143	E.D. Bloom, C. Peck	(SLAC, CIT)	REFID=21682
LEMOIGNE	82	PRL 49 259	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=21314
BESCH	81	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					
Translated from YAF 34 1471					
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

NODE=M870

BRANCHING RATIOS OF $\psi(2S)$ AND $\chi_{c0,1,2}$

Updated March 2020 by J.J. Hernández-Rey (IFIC, Valencia), 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.

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.

Fit information

This is an overall fit to 4 total widths, 1 partial width, 26 combinations of partial widths, 24 branching ratios, and 108 combinations of branching ratios. Of the latter 62 involve decays of more than one particle.

The overall fit uses 248 measurements to determine 49 parameters and has a χ^2 of 378.1 for 199 degrees of freedom.

The relatively high χ^2 of the fit, 1.9 per d.o.f., can be traced back to a few specific discrepancies in the data. No scaling factors to fit uncertainties have been applied.

In the listing we provide the inter-particle correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, in percent, from the fit to the corresponding parameter x_i .

References

1. Y.F. Gu and X.H. Li, Phys. Lett. **B449**, 361 (1999).
 2. C. Patrignani, Phys. Rev. **D64**, 034017 (2001).
 3. Particle Data Group, K.Hagiwara *et al.*, Phys. Rev. **D68**, 010001 (2002).
-

$\chi_{c0}(1P)$

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

NODE=M056

 $\chi_{c0}(1P)$ MASS

NODE=M056M

NODE=M056M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
3414.71 ± 0.30 OUR AVERAGE				
3413.0 ± 1.9 ± 0.6	933	¹ AAIJ	17BB LHCb	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3414.2 ± 0.5 ± 2.3	5.4k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \chi_{c0} \rightarrow \text{hadrons}$
3406 ± 7 ± 6	230	² ABE	07 BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$
3414.21 ± 0.39 ± 0.27		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c0}$
3414.7 $^{+0.7}_{-0.6}$ ± 0.2		³ ANDREOTTI	03 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow \pi^0\pi^0$
3415.5 ± 0.4 ± 0.4	392	⁴ BAGNASCO	02 E835	$\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi\gamma$
3417.4 $^{+1.8}_{-1.9}$ ± 0.2		³ AMBROGIANI	99B E835	$\bar{p}p \rightarrow e^+e^-\gamma$
3414.1 ± 0.6 ± 0.8		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3417.8 ± 0.4 ± 4		³ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3416 ± 3 ± 4		⁵ TANENBAUM	78 MRK1	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3414.6 ± 1.1	266	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3416.5 ± 3.0		EISENSTEIN	01 CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c0}$
3422 ± 10		⁵ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3415 ± 9		⁵ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$

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.

NODE=M056M;LINKAGE=A

NODE=M056M;LINKAGE=EB

NODE=M056M;LINKAGE=C

NODE=M056M;LINKAGE=NW

NODE=M056M;LINKAGE=D

 $\chi_{c0}(1P)$ WIDTH

NODE=M056W

NODE=M056W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
10.8 ± 0.6 OUR 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.

NODE=M056W;LINKAGE=AN

 $\chi_{c0}(1P)$ DECAY MODES

NODE=M056215;NODE=M056

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level

Hadronic decays

Γ_1	$2(\pi^+\pi^-)$	(2.34 ± 0.18) %
Γ_2	$\rho^0\pi^+\pi^-$	(9.1 ± 2.9) × 10 ⁻³
Γ_3	$\rho^0\rho^0$	
Γ_4	$f_0(980)f_0(980)$	(6.6 ± 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	$\pi^+\pi^-K^+K^-$	(1.81 ± 0.14) %

NODE=M056;CLUMP=A

DESIG=3

DESIG=9

DESIG=54

DESIG=20

DESIG=61

DESIG=62

DESIG=70

DESIG=5

Γ_9	$K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow \pi^+ \pi^- K^+ K^-$	$(9.8 \pm_{-2.8}^{+4.0}) \times 10^{-4}$		DESIG=31
Γ_{10}	$K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$(8.0 \pm_{-2.4}^{+2.0}) \times 10^{-4}$		DESIG=32
Γ_{11}	$K_1(1270)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$(6.3 \pm 1.9) \times 10^{-3}$		DESIG=33
Γ_{12}	$K_1(1400)^+ K^- + \text{c.c.} \rightarrow \pi^+ \pi^- K^+ K^-$	$< 2.7 \times 10^{-3}$	CL=90%	DESIG=34
Γ_{13}	$f_0(980) f_0(980)$	$(1.6 \pm_{-0.9}^{+1.0}) \times 10^{-4}$		DESIG=23
Γ_{14}	$f_0(980) f_0(2200)$	$(7.9 \pm_{-2.5}^{+2.0}) \times 10^{-4}$		DESIG=24
Γ_{15}	$f_0(1370) f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	DESIG=25
Γ_{16}	$f_0(1370) f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	DESIG=26
Γ_{17}	$f_0(1370) f_0(1710)$	$(6.7 \pm_{-2.3}^{+3.5}) \times 10^{-4}$		DESIG=27
Γ_{18}	$f_0(1500) f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=28
Γ_{19}	$f_0(1500) f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	DESIG=29
Γ_{20}	$f_0(1500) f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	DESIG=30
Γ_{21}	$K^+ K^- \pi^+ \pi^- \pi^0$	$(8.6 \pm 0.9) \times 10^{-3}$		DESIG=75
Γ_{22}	$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(4.2 \pm 0.4) \times 10^{-3}$		DESIG=87
Γ_{23}	$K^+ K^- \pi^0 \pi^0$	$(5.6 \pm 0.9) \times 10^{-3}$		DESIG=63
Γ_{24}	$K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(2.49 \pm 0.33) \%$		DESIG=65
Γ_{25}	$\rho^+ K^- K^0 + \text{c.c.}$	$(1.21 \pm 0.21) \%$		DESIG=66
Γ_{26}	$K^*(892)^- K^+ \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$	$(4.6 \pm 1.2) \times 10^{-3}$		DESIG=67
Γ_{27}	$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		DESIG=41
Γ_{28}	$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		DESIG=68
Γ_{29}	$3(\pi^+ \pi^-)$	$(1.20 \pm 0.18) \%$		DESIG=4
Γ_{30}	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.5 \pm 1.6) \times 10^{-3}$		DESIG=10
Γ_{31}	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		DESIG=21
Γ_{32}	$\pi \pi$	$(8.51 \pm 0.33) \times 10^{-3}$		DESIG=18
Γ_{33}	$\pi^0 \eta$	$< 1.8 \times 10^{-4}$		DESIG=35
Γ_{34}	$\pi^0 \eta'$	$< 1.1 \times 10^{-3}$		DESIG=36
Γ_{35}	$\pi^0 \eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	DESIG=86
Γ_{36}	$\eta \eta$	$(3.01 \pm 0.19) \times 10^{-3}$		DESIG=13
Γ_{37}	$\eta \eta'$	$(9.1 \pm 1.1) \times 10^{-5}$		DESIG=37
Γ_{38}	$\eta' \eta'$	$(2.17 \pm 0.12) \times 10^{-3}$		DESIG=46
Γ_{39}	$\omega \omega$	$(9.7 \pm 1.1) \times 10^{-4}$		DESIG=22
Γ_{40}	$\omega \phi$	$(1.41 \pm 0.13) \times 10^{-4}$		DESIG=76
Γ_{41}	$\omega K^+ K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		DESIG=88
Γ_{42}	$K^+ K^-$	$(6.05 \pm 0.31) \times 10^{-3}$		DESIG=2
Γ_{43}	$K_S^0 K_S^0$	$(3.16 \pm 0.17) \times 10^{-3}$		DESIG=15
Γ_{44}	$\pi^+ \pi^- \eta$	$< 2.0 \times 10^{-4}$	CL=90%	DESIG=50
Γ_{45}	$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	DESIG=53
Γ_{46}	$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	DESIG=17
Γ_{47}	$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=47
Γ_{48}	$K^+ K^- \eta$	$< 2.3 \times 10^{-4}$	CL=90%	DESIG=51
Γ_{49}	$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		DESIG=42
Γ_{50}	$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		DESIG=94
Γ_{51}	$K^+ K^- K^+ K^-$	$(2.82 \pm 0.29) \times 10^{-3}$		DESIG=14
Γ_{52}	$K^+ K^- \phi$	$(9.7 \pm 2.5) \times 10^{-4}$		DESIG=44
Γ_{53}	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		DESIG=91
Γ_{54}	$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		DESIG=92
Γ_{55}	$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		DESIG=89
Γ_{56}	$\phi \phi$	$(8.0 \pm 0.7) \times 10^{-4}$		DESIG=16
Γ_{57}	$\phi \phi \eta$	$(8.4 \pm 1.0) \times 10^{-4}$		DESIG=96
Γ_{58}	$p \bar{p}$	$(2.21 \pm 0.08) \times 10^{-4}$		DESIG=11
Γ_{59}	$p \bar{p} \pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.3	DESIG=48

Г60	$p\bar{p}\eta$	$(3.5 \pm 0.4) \times 10^{-4}$		DESIG=52
Г61	$p\bar{p}\omega$	$(5.2 \pm 0.6) \times 10^{-4}$		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	$p\bar{p}K^+K^-$ (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	$\bar{p}n\pi^+\pi^0$	$(2.21 \pm 0.18) \times 10^{-3}$		DESIG=84
Г71	$\Lambda\bar{\Lambda}$	$(3.27 \pm 0.24) \times 10^{-4}$		DESIG=19
Г72	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.18 \pm 0.13) \times 10^{-3}$		DESIG=38
Г73	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (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	$K^+\bar{p}\Lambda + \text{c.c.}$	$(1.25 \pm 0.12) \times 10^{-3}$	S=1.3	DESIG=49
Г77	$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(4.8 \pm 0.9) \times 10^{-4}$		DESIG=98
Г78	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(2.9 \pm 0.7) \times 10^{-4}$		DESIG=72
Г79	$\Lambda(1520)\bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		DESIG=73
Г80	$\Sigma^0\bar{\Sigma}^0$	$(4.68 \pm 0.32) \times 10^{-4}$		DESIG=58
Г81	$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(3.52 \pm 0.27) \times 10^{-4}$		DESIG=97
Г82	$\Sigma^+\bar{\Sigma}^-$	$(4.6 \pm 0.8) \times 10^{-4}$	S=2.6	DESIG=59
Г83	$\Sigma^-\bar{\Sigma}^+$	$(5.1 \pm 0.5) \times 10^{-4}$		DESIG=99
Г84	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		DESIG=80
Г85	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$(2.3 \pm 0.7) \times 10^{-4}$		DESIG=81
Г86	$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(1.94 \pm 0.35) \times 10^{-4}$		DESIG=85
Г87	$\Xi^0\bar{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		DESIG=60
Г88	$\Xi^-\bar{\Xi}^+$	$(4.8 \pm 0.7) \times 10^{-4}$		DESIG=39
Г89	$\eta_c\pi^+\pi^-$	$< 7 \times 10^{-4}$	CL=90%	DESIG=90

Radiative decays

Г90	$\gamma J/\psi(1S)$	$(1.40 \pm 0.05) \%$		NODE=M056;CLUMP=B DESIG=6
Г91	$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	DESIG=55
Г92	$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	DESIG=56
Г93	$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	DESIG=57
Г94	$\gamma\gamma$	$(2.04 \pm 0.09) \times 10^{-4}$		DESIG=7
Г95	$e^+e^- J/\psi(1S)$	$(1.33 \pm 0.29) \times 10^{-4}$		DESIG=93
Г96	$\mu^+\mu^- J/\psi(1S)$	$< 1.9 \times 10^{-5}$	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 84 branching ratios uses 248 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 378.1$ for 199 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	24									
x_8	9	2								
x_{30}	5	1	28							
x_{32}	8	2	10	3						
x_{36}	4	1	5	1	14					
x_{42}	8	2	8	3	18	11				
x_{43}	7	2	8	2	18	10	14			
x_{51}	5	1	5	2	9	5	7	7		
x_{56}	7	2	6	2	9	5	7	7	4	
x_{58}	3	1	4	1	3	-1	7	7	3	3
x_{71}	4	1	5	1	13	8	10	10	5	5
x_{90}	5	1	6	2	17	11	13	12	6	6
x_{94}	-8	-2	-2	-3	14	9	10	10	3	1
Γ	-26	-6	-19	-10	-15	-7	-14	-12	-10	-13
	x_1	x_2	x_8	x_{30}	x_{32}	x_{36}	x_{42}	x_{43}	x_{51}	x_{56}

x_{71}	5			
x_{90}	-19	9		
x_{94}	6	9	13	
Γ	-4	-7	-9	-38
	x_{58}	x_{71}	x_{90}	x_{94}

$\chi_{c0}(1P)$ PARTIAL WIDTHS

NODE=M056217

$$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M056223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{58} \Gamma_{90} / \Gamma$$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

33.6 ± 2.3 OUR FIT

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

26.6 ± 2.6 ± 1.4 392 ^{1,2} BAGNASCO 02 E835 $\bar{p}p \rightarrow \chi_{c0} \rightarrow J/\psi \gamma$

48.7 ^{+11.3} _{-8.9} ± 2.4 ^{1,2} AMBROGIANI 99B E835 $\bar{p}p \rightarrow \gamma J/\psi$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.

² 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.

NODE=M056G;LINKAGE=7A

NODE=M056G;LINKAGE=KS

$$\chi_{c0}(1P) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$$

NODE=M056224

$$\Gamma(2(\pi^+ \pi^-)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$$

$$\Gamma_1 \Gamma_{94} / \Gamma$$

VALUE (eV) EVTS DOCUMENT ID TECN COMMENT

52 ± 4 OUR 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

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

$$\Gamma_3 \Gamma_{94} / \Gamma$$

VALUE (eV) CL% EVTS DOCUMENT ID TECN COMMENT

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

<12 90 <252 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(\pi^+ \pi^-)$

NODE=M056G07

NODE=M056G07

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{894}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
40.0±3.5 OUR 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

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{2194}/\Gamma$$

VALUE (eV)	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

$$\Gamma(K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{3094}/\Gamma$$

VALUE (eV)	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

$$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{3194}/\Gamma$$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G10
NODE=M056G10

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

<6	90	<148	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow K^+K^-\pi^+\pi^-$

$$\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{3294}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
18.8± 1.3 OUR FIT				
23 ± 5 OUR AVERAGE				

NODE=M056G3
NODE=M056G3

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

¹We multiplied the measurement by 3 to convert from $\pi^0\pi^0$ to $\pi\pi$. Interference with the continuum included.

²We have multiplied $\pi^+\pi^-$ measurement by 3/2 to obtain $\pi\pi$.

NODE=M056G3;LINKAGE=UE

NODE=M056G;LINKAGE=NA

$$\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{3694}/\Gamma$$

VALUE (eV)	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

¹Interference with the continuum not included.

NODE=M056G06;LINKAGE=UE

$$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{3994}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M056G02
NODE=M056G02

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

<3.9	90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow 2(\pi^+\pi^-\pi^0)$

¹Using $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G02;LINKAGE=LI

$$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{4094}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M056G03
NODE=M056G03

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

<0.34	90	¹ LIU	12B	BELL $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

¹Using $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$ and $B(\omega \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7)\%$.

NODE=M056G03;LINKAGE=LI

$$\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{4294}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G4
NODE=M056G4

13.4±1.0 OUR FIT				
14.3±1.6±2.3	153 ± 17	NAKAZAWA	05	BELL 10.6 $e^+e^- \rightarrow e^+e^-K^+K^-$

$$\Gamma(K_S^0\bar{K}_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{4394}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G5
NODE=M056G5

7.0 ±0.5 OUR FIT				
8.7 ±1.7 ±0.9	266	¹ UEHARA	13	BELL $\gamma\gamma \rightarrow K_S^0\bar{K}_S^0$

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

7.00±0.65±0.71	134 ± 12	CHEN	07B	BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$

¹Supersedes CHEN 07B.

NODE=M056G5;LINKAGE=UE

$$\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{5194}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M056G11
NODE=M056G11

6.2±0.7 OUR FIT				
7.9±1.3±1.1	215 ± 36	UEHARA	08	BELL $\gamma\gamma \rightarrow \chi_{c0} \rightarrow 2(K^+K^-)$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_{56}\Gamma_{94}/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
1.76±0.18 OUR 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

NODE=M056G12:LINKAGE=LI

$\chi_{c0}(1P)$ BRANCHING RATIOS

NODE=M056220

HADRONIC DECAYS

NODE=M056305

$\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$	Γ_1/Γ
VALUE	DOCUMENT ID
0.0234 ± 0.0018 OUR FIT	

NODE=M056R2
NODE=M056R2

$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma(2(\pi^+ \pi^-))$	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

$\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$	DOCUMENT ID	Γ_2/Γ
0.0091 ± 0.0029 OUR FIT		

NODE=M056R9
NODE=M056R9

$\Gamma(f_0(980)f_0(980))/\Gamma_{\text{total}}$					Γ_4/Γ
<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$6.6 \pm 2.1 \pm 0.1$	36 ± 9	¹ ABLIKIM	04G BES	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$	

NODE=M056R24
NODE=M056R24

¹ ABLIKIM 04G reports $[\Gamma(\chi_{c0}(1P) \rightarrow f_0(980)f_0(980))/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))] = (6.5 \pm 1.6 \pm 1.3) \times 10^{-5}$ which we divide by our best value $\text{B}(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R24;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	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R62
NODE=M056R62

¹ HE 08B reports $3.54 \pm 0.10 \pm 0.43 \pm 0.18$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}] \times [\mathcal{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\mathcal{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\mathcal{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R62: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	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R63
NODE=M056R63

¹ HE 08B reports $3.04 \pm 0.18 \pm 0.42 \pm 0.16$ % from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow \rho^+ \pi^- \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R63:LINKAGE=HE

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:LINKAGE=OC

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$					Γ_7/Γ
<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
$3.3 \pm 0.4 \pm 0.1$	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 $[\Gamma(\chi_{c0}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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

$\Gamma(\pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}$	Γ_8/Γ
VALUE (units 10^{-3}) 18.1±1.4 OUR FIT	DOCUMENT ID

NODE=M056R3
NODE=M056R3

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}) / \Gamma(\pi^+ \pi^- K^+ K^-)$$

 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

9.8^{+3.6}_{-2.8}±0.2

83

¹ ABLIKIM 05Q BES2 $\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$ NODE=M056R36
NODE=M056R36

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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}±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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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±1.9±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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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

16.2^{+10.4}_{-9.0}±0.3

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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}±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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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
$6.7^{+3.5}_{-2.3} \pm 0.1$	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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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	$\psi(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-$

NODE=M056R34
NODE=M056R34

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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;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	$\psi(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^-$

NODE=M056R35
 NODE=M056R35

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$. 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;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	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R85
 NODE=M056R85

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

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	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R86
 NODE=M056R86

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

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	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R64
 NODE=M056R64

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R64;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
$2.49 \pm 0.33 \pm 0.05$	401.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R66
 NODE=M056R66

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R66;LINKAGE=HE

 $\Gamma(\rho^+ K^- K^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$1.21 \pm 0.21 \pm 0.02$	179.7	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M056R67
 NODE=M056R67

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R67;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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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
$5.7 \pm 1.0 \pm 0.1$	152 $\pm$ 14	¹ ABLIKIM	05o BES2	$\psi(2S) \rightarrow \gamma \chi_{c0}$

NODE=M056R47
 NODE=M056R47

¹ ABLIKIM 05o 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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±0.07±0.01	56.4	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R69
NODE=M056R69

NODE=M056R69;LINKAGE=HE

$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{29}/Γ

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

12.0±1.8 OUR EVALUATION Treating systematic error as correlated.

12.0±1.7 OUR AVERAGE

11.7±1.0±1.9	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma \chi_{c0}$
12.5±2.9±0.5	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 $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.6 \pm 0.5)\%$.

NODE=M056R4
NODE=M056R4

→ UNCHECKED ←

NODE=M056R;LINKAGE=X1

$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE	DOCUMENT ID

0.0075±0.0016 OUR FIT

NODE=M056R10
NODE=M056R10

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

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

1.72^{+0.60}_{-0.54}±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. • • •

1.56±0.40±0.03 30 ± 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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=A1

NODE=M056R;LINKAGE=AL
NODE=M056R26;LINKAGE=AB

$\Gamma(\pi\pi)/\Gamma_{\text{total}}$ Γ_{32}/Γ

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

8.51±0.33 OUR FIT

NODE=M056R22
NODE=M056R22

$\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.6 × 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_{36}/Γ

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

3.01±0.19 OUR FIT

NODE=M056R13
NODE=M056R13

$\Gamma(\eta\eta)/\Gamma(\pi\pi)$ Γ_{36}/Γ_{32}

VALUE	DOCUMENT ID	TECN	COMMENT

0.353±0.025 OUR FIT

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

0.26 ± 0.09 ^{+0.03} _{-0.02}	¹ ANDREOTTI	05C E835	$\bar{p} p \rightarrow 2 \text{ mesons}$
0.24 ± 0.10 ± 0.08	¹ BAI	03C BES	$\psi(2S) \rightarrow 5\gamma$

¹ We have multiplied $\pi^0 \pi^0$ measurement by 3 to obtain $\pi\pi$.

NODE=M056R20
NODE=M056R20

NODE=M056R;LINKAGE=D1

$\Gamma(\eta\eta')/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
9.1±1.1±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 ± 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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±0.12 OUR AVERAGE				
2.23±0.13±0.05	2.5k	¹ ABLIKIM	17AI BES3	$\psi(2S) \rightarrow \gamma\eta'\eta'$
2.00±0.21±0.04	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±0.41±0.03	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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.97±0.11 OUR AVERAGE				
0.93±0.11±0.02	991	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$
2.16±0.66±0.04	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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.41±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±0.02	76	^{2,3} ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$

NODE=M056R76
NODE=M056R76

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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;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 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R87
NODE=M056R87

NODE=M056R87;LINKAGE=A

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

VALUE (units 10^{-3})	DOCUMENT ID
6.05±0.31 OUR FIT	

NODE=M056R6
NODE=M056R6

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

VALUE (units 10^{-3})	DOCUMENT ID
3.16±0.17 OUR FIT	

NODE=M056R15
NODE=M056R15

$\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.371±0.023 OUR FIT			

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

0.31 ±0.05 ±0.05 ^{1,2} CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$

¹ Using $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from the $\pi^+\pi^-$ measurement of NAKAZAWA 05 rescaled by 3/2 to convert to $\pi\pi$.

² Not independent from other measurements.

NODE=M056R53
NODE=M056R53

NODE=M056R53;LINKAGE=CH

NODE=M056R53;LINKAGE=NI

$\Gamma(K_S^0 K_S^0)/\Gamma(K^+ K^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.52±0.04 OUR FIT			

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

0.49±0.07±0.08 ^{1,2} CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c0}$

¹ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.

² Not independent from other measurements.

NODE=M056R52
NODE=M056R52

NODE=M056R52;LINKAGE=CH
NODE=M056R52;LINKAGE=NI

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

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

NODE=M056R51
NODE=M056R51

NODE=M056R51;LINKAGE=AT

$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{46}/Γ

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	$\psi(2S) \rightarrow \gamma \chi_{c0}$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

³ We have multiplied the $K_S^0 K^+ \pi^-$ measurement by a factor of 2 to convert to $K^0 K^+ \pi^-$.

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
NODE=M056R17

NODE=M056R17;LINKAGE=AT

NODE=M056R17;LINKAGE=AB

NODE=M056R17;LINKAGE=BA

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	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.				

NODE=M056R05
NODE=M056R05

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	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.				

NODE=M056R09
NODE=M056R09

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	$\psi(2S) \rightarrow \gamma \chi_{c0}$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M056R48
NODE=M056R48

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	$\psi(2S) \rightarrow \gamma 4K_S^0$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M056R95
NODE=M056R95

NODE=M056R95;LINKAGE=A

$\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
2.82 ± 0.29 OUR FIT	

NODE=M056R14
NODE=M056R14

$\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ 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	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R01
NODE=M056R01

NODE=M056R01;LINKAGE=AB

$\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **$3.68 \pm 0.30 \pm 0.50$**

DOCUMENT ID

TECN

COMMENT

ABLIKIM

15M

BES3

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ Γ_{53}/Γ NODE=M056R90
NODE=M056R90 $\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **$1.90 \pm 0.14 \pm 0.32$**

DOCUMENT ID

TECN

COMMENT

ABLIKIM

15M

BES3

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ Γ_{54}/Γ NODE=M056R91
NODE=M056R91 $\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **$1.18 \pm 0.07 \pm 0.13$**

EVTS

538

DOCUMENT ID

TECN

COMMENT

¹ ABLIKIM

13B

BES3

 $e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$ Γ_{55}/Γ NODE=M056R88
NODE=M056R88¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.68 \pm 0.31)\%$.

NODE=M056R88;LINKAGE=A

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **0.80 ± 0.07 OUR FIT**

DOCUMENT ID

 Γ_{56}/Γ NODE=M056R16
NODE=M056R16 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) **$8.4 \pm 0.7 \pm 0.6$**

EVTS

186.6

DOCUMENT ID

TECN

COMMENT

¹ ABLIKIM

20B

BES3

 $\psi(2S) \rightarrow \gamma \phi \phi \eta$ Γ_{57}/Γ NODE=M056R98
NODE=M056R98¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$.

NODE=M056R98;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) **2.21 ± 0.08 OUR FIT**

DOCUMENT ID

 Γ_{58}/Γ NODE=M056R11
NODE=M056R11 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **0.70 ± 0.07 OUR AVERAGE**

Error includes scale factor of 1.3.

 $0.73 \pm 0.06 \pm 0.01$ ¹ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p \bar{p} X$ $0.56 \pm 0.12 \pm 0.01$ ² ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ Γ_{59}/Γ NODE=M056R06
NODE=M056R06¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06;LINKAGE=ON

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R06;LINKAGE=AT

 $\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3}) **0.35 ± 0.04 OUR AVERAGE** $0.35 \pm 0.04 \pm 0.01$ ¹ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p \bar{p} X$ $0.37 \pm 0.11 \pm 0.01$ ² ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$ Γ_{60}/Γ NODE=M056R50
NODE=M056R50¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=ON

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R50;LINKAGE=AT

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{61}/Γ NODE=M056R70
NODE=M056R70**0.52±0.06±0.01**¹

ONLYSI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

NODE=M056R70;LINKAGE=ON

¹ ONLYSI 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{62}/Γ NODE=M056R75
NODE=M056R75**6.0±1.4±0.1**

42 ± 8

¹

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M056R75;LINKAGE=AB

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{63}/Γ NODE=M056R7
NODE=M056R7**2.1 ±0.7 OUR EVALUATION**

Error includes scale factor of 1.4. Treating systematic error as correlated.

→ UNCHECKED ←

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

 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056R7;LINKAGE=X1

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

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

VALUE (%)

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{64}/Γ NODE=M056R65
NODE=M056R65**0.104±0.028±0.002**

39.5

¹

HE

08B

CLEO

 $e^+e^- \rightarrow \gamma h^+h^-h^0h^0$

NODE=M056R65;LINKAGE=HE

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(p\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{65}/Γ NODE=M056R72
NODE=M056R72**1.22±0.26±0.02**

48 ± 8

¹

ABLIKIM

11F

BES3

 $\psi(2S) \rightarrow \gamma p\bar{p}K^+K^-$

NODE=M056R72;LINKAGE=AB

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

CL%

DOCUMENT ID

TECN

COMMENT

 Γ_{66}/Γ NODE=M056R46
NODE=M056R46**<8.8**

90

¹

ABLIKIM

06D

BES2

 $\psi(2S) \rightarrow \chi_{c0}\gamma$

NODE=M056R;LINKAGE=AB

¹ Using $B(\psi(2S) \rightarrow \chi_{c0}\gamma) = (9.2 \pm 0.5)\%$

 $\Gamma(p\bar{n}\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{67}/Γ NODE=M056R49
NODE=M056R49**12.7±1.1 OUR AVERAGE**

12.9±1.1±0.3

5150

¹

ABLIKIM

12J

BES3

 $\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$

11.2±3.1±0.2

²

ABLIKIM

06I

BES2

 $\psi(2S) \rightarrow \gamma p\pi^-X$

NODE=M056R49;LINKAGE=AL

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R49;LINKAGE=AB

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
13.7$\pm$1.2$\pm$0.3	5808	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$

NODE=M056R82
 NODE=M056R82

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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$\pm$2.0$\pm$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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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$\pm$1.8$\pm$0.5	2757	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$

NODE=M056R84
 NODE=M056R84

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
3.27$\pm$0.24 OUR FIT	

NODE=M056R23
 NODE=M056R23

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
118$\pm$12$\pm$2		426	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R44
 NODE=M056R44

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

<400	90	² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0}\gamma$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$

NODE=M056R77
 NODE=M056R77

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$

NODE=M056R78
 NODE=M056R78

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$

NODE=M056R79
 NODE=M056R79

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

NODE=M056R79;LINKAGE=AL

$\Gamma(K^+ \bar{p} \Lambda + c.c.) / \Gamma_{\text{total}}$ Γ_{76} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.25 ± 0.12 OUR AVERAGE				Error includes scale factor of 1.3.
1.30 ± 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	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ABLIKIM 13D reports $(1.32 \pm 0.03 \pm 0.10) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + c.c.) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.68 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $(1.07 \pm 0.17 \pm 0.12) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda + c.c.) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R07
NODE=M056R07

NODE=M056R07;LINKAGE=AB

NODE=M056R07;LINKAGE=LB
NODE=M056R07;LINKAGE=AT

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + c.c.) / \Gamma_{\text{total}}$ Γ_{77} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.8 ± 0.9 ± 0.1	254	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c0}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + c.c.) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ $= (4.7 \pm 0.7 \pm 0.5) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R99
NODE=M056R99

NODE=M056R99;LINKAGE=A

 $\Gamma(K^+ \bar{p} \Lambda(1520) + c.c.) / \Gamma_{\text{total}}$ Γ_{78} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.7 ± 0.1	62 ± 12	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $(3.00 \pm 0.58 \pm 0.50) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c0}(1P) \rightarrow K^+ \bar{p} \Lambda(1520) + c.c.) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R73
NODE=M056R73

NODE=M056R73;LINKAGE=AB

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520)) / \Gamma_{\text{total}}$ Γ_{79} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1 ± 1.2 ± 0.1	28 ± 10	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M056R74
NODE=M056R74

NODE=M056R74;LINKAGE=AB

 $\Gamma(\Sigma^0 \bar{\Sigma}^0) / \Gamma_{\text{total}}$ Γ_{80} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.68 ± 0.32 OUR AVERAGE				

4.82 ± 0.34 ± 0.10	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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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
NODE=M056R59

NODE=M056R59;LINKAGE=A

NODE=M056R59;LINKAGE=NA

NODE=M056R59;LINKAGE=AB

NODE=M056R59;LINKAGE=B

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.6 ± 0.8 OUR AVERAGE	Error includes scale factor of 2.6.			
5.10 ± 0.35 ± 0.10	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	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.1 ± 0.2 ± 0.4	2143	¹ ABLIKIM	20I BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$.				

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
16.2 ± 5.8 ± 0.3	27	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
23.2 ± 6.5 ± 0.5	33	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

 $\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.94 ± 0.35 ± 0.04	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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1 ± 0.8 ± 0.1	23.3 ± 4.9	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

 Γ_{82}/Γ

NODE=M056R60
NODE=M056R60

NODE=M056R60;LINKAGE=A

NODE=M056R60;LINKAGE=NA

NODE=M056R60;LINKAGE=AB

NODE=M056R60;LINKAGE=B

 Γ_{83}/Γ

NODE=M056P00
NODE=M056P00

NODE=M056P00;LINKAGE=A

 Γ_{84}/Γ

NODE=M056R80
NODE=M056R80

NODE=M056R80;LINKAGE=AL

 Γ_{85}/Γ

NODE=M056R81
NODE=M056R81

NODE=M056R81;LINKAGE=AL

 Γ_{86}/Γ

NODE=M056R92
NODE=M056R92

NODE=M056R92;LINKAGE=A

 Γ_{87}/Γ

NODE=M056R61
NODE=M056R61

NODE=M056R61;LINKAGE=NA

$\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{88}/Γ

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

4.8±0.7±0.1	95 ± 11		¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \Xi^-$

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

<10.3	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \chi_{c0} \gamma$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c0} \gamma) = (9.2 \pm 0.5)\%$

NODE=M056R45
 NODE=M056R45

NODE=M056R45;LINKAGE=NA

NODE=M056R45;LINKAGE=AB

 $\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{89}/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 1.06×10^8 $\psi(2S)$ 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

18.8±1.0 OUR 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

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±0.5 OUR FIT**4.0±1.2^{+0.5}_{-0.3}**

	ANDREOTTI	05C E835	$\bar{p}p \rightarrow \eta\eta$

NODE=M056R40
 NODE=M056R40

 $\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\eta'\eta)/\Gamma_{\text{total}}$ $\Gamma_{58}/\Gamma \times \Gamma_{37}/\Gamma$

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 ————

NODE=M056310

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{90}/Γ

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

1.40±0.05 OUR FIT

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

0.25±0.16±2.15	12k	¹ ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$

2.0 ± 0.2 ± 0.2		² ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$

¹ Not independent from $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))$ and the product $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) \times B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))$ also measured in ABLIKIM 17U.

² Uses $B(\psi(2S) \rightarrow \gamma \chi_{c0} \rightarrow \gamma \gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma \chi_{c0})$ from ATHAR 04.

NODE=M056R8
 NODE=M056R8

NODE=M056R8;LINKAGE=A

NODE=M056R8;LINKAGE=AD

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{91}/Γ

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

NODE=M056R56
NODE=M056R56

NODE=M056R56;LINKAGE=BE

NODE=M056R56;LINKAGE=AB

 $\Gamma(\gamma\omega)/\Gamma_{\text{total}}$ Γ_{92}/Γ

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

NODE=M056R57
NODE=M056R57

NODE=M056R57;LINKAGE=BE

NODE=M056R57;LINKAGE=AB

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$ Γ_{93}/Γ

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = 9.79 \times 10^{-2}$.

NODE=M056R58
NODE=M056R58

NODE=M056R58;LINKAGE=BE

NODE=M056R58;LINKAGE=AB

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{94}/Γ

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

2.04 ± 0.09 OUR FIT

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

<7	90	¹ WICHT	08 BELL	$B^\pm \rightarrow K^\pm \gamma\gamma$

¹ WICHT 08 reports $[\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c0} K^+)] < 0.11 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c0} K^+) = 1.51 \times 10^{-4}$.

NODE=M056R1
NODE=M056R1

NODE=M056R1;LINKAGE=WI

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{95}/Γ

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

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

$1.54 \pm 0.33 \pm 0.03$	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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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_{95}/Γ_{90}

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

$$\Gamma(\mu^+ \mu^- J/\psi(1S))/\Gamma(e^+ e^- J/\psi(1S))$$

$$\Gamma_{96}/\Gamma_{95}$$

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

$$\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$$

$$\Gamma_{94}/\Gamma_{90}$$

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

1.45±0.08 OUR 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

NODE=M056R;LINKAGE=AN

NODE=M056R;LINKAGE=7A

$$\Gamma(p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{90}/\Gamma$$

VALUE (units 10^{-7})	EVTs	DOCUMENT ID	TECN	COMMENT

31.1±1.5 OUR FIT

28.2±2.1 OUR AVERAGE

28.0±1.9±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} ±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

NODE=M056R;LINKAGE=KS

NODE=M056R19;LINKAGE=7A
NODE=M056R19;LINKAGE=AN

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

$$\Gamma_{58}/\Gamma \times \Gamma_{94}/\Gamma$$

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

4.52±0.27 OUR FIT

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

6.52±1.18 ^{+0.48} _{-0.72}	¹ ANDREOTTI 04	E835	$p\bar{p} \rightarrow \chi_{c0} \rightarrow \gamma\gamma$

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.

NODE=M056R25
NODE=M056R25

NODE=M056R25;LINKAGE=AN

$\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M056230

$$\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{58}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

21.7±0.9 OUR FIT

23.7±1.0 OUR AVERAGE

23.7±0.8±0.9	1222	ABLIKIM	13v BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$
23.7±1.4±1.4	383 ± 22	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
23.6 ^{+3.7} _{-3.4} ±3.4	89.5 ⁺¹⁴ ₋₁₃	BAI	04F BES	$\psi(2S) \rightarrow \gamma \chi_{c0}(1P) \rightarrow \gamma \bar{p}p$

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

NODE=M056B6;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{58}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

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

6.25±0.26 OUR FIT

4.6 ±1.9

¹ BAI	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

NODE=M056B;LINKAGE=B1

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{71} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-6}) EVTS DOCUMENT ID TECN COMMENT

32.0±2.3 OUR FIT

31.7±2.3 OUR AVERAGE

32.0±1.9±2.2 369 ¹ ABLIKIM 13H BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$
 31.2±3.3±2.0 131 ± 12 ² NAIK 08 CLEO $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.62 \pm 0.31)\%$.

² 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 $B(\psi(2S) \rightarrow \gamma \chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B20
 NODE=M056B20

NODE=M056B20;LINKAGE=AB

NODE=M056B20;LINKAGE=NA

$$\Gamma(\chi_{c0}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{71} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

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

9.2±0.7 OUR FIT

13.0^{+3.6}_{-3.5}±2.5 15.2^{+4.2}_{-4.0} ¹ BAI 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

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{90} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

0.138±0.005 OUR FIT

0.147±0.029 OUR AVERAGE

Error includes scale factor of 4.6.

0.158±0.003±0.006 4.8k ¹ ABLIKIM 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 ² OREGLIA 82 CBAL $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.4 ±0.3 ³ BRANDELIK 79B DASP $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.16 ±0.11 ³ BARTEL 78B CNTR $\psi(2S) \rightarrow \gamma \chi_{c0}$
 3.3 ±1.7 ⁴ BIDDICK 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 ⁵ ABLIKIM 120 BES3 $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.125±0.007±0.013 560 ⁶ MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.18 ±0.01 ±0.02 172 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=M056B2
 NODE=M056B2

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

$$\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{90} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_9^{\psi(2S)}$$

$$\Gamma_{90} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_9^{\psi(2S)} = \Gamma_{90} / \Gamma \times \Gamma_{153}^{\psi(2S)} / (\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.343 \Gamma_{154}^{\psi(2S)} + 0.190 \Gamma_{155}^{\psi(2S)})$$

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

0.224±0.009 OUR FIT

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

0.201±0.011±0.021 560 ¹ MENDEZ 08 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$
 0.31 ±0.02 ±0.03 172 ADAM 05A CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M056B7

NODE=M056B7

NODE=M056B7

NODE=M056B7;LINKAGE=ME

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{90}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

0.397±0.015 OUR 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 08¹ Not independent from other values reported by ADAM 05A.NODE=M056B8
NODE=M056B8

NODE=M056B;LINKAGE=AD

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \gamma \gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{94}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

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

2.00±0.08 OUR 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.NODE=M056B3
NODE=M056B3

NODE=M056B3;LINKAGE=A

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{32}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

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

8.34±0.29 OUR 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 $\pi \pi$.NODE=M056B22
NODE=M056B22

OCCUR=2

NODE=M056B22;LINKAGE=AB

NODE=M056B22;LINKAGE=AS

NODE=M056B22;LINKAGE=AN

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \pi \pi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{32}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

24.0±0.8 OUR 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=M056B5
NODE=M056B5

NODE=M056B;LINKAGE=D1

NODE=M056B;LINKAGE=D2

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta \eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P))}{\Gamma_{\text{total}}} \quad \frac{\Gamma_{36}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

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

2.95±0.18 OUR FIT**3.12±0.19 OUR AVERAGE**3.23±0.09±0.23 2132 ¹ ABLIKIM 10A BES3 $e^+e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c0}$ 2.93±0.12±0.29 0.9k ² ASNER 09 CLEO $\psi(2S) \rightarrow \gamma \eta \eta$

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

2.86±0.46±0.37 48 ³ ADAMS 07 CLEO $\psi(2S) \rightarrow \gamma \chi_{c0}$ NODE=M056B11
NODE=M056B11

- ¹ Calculated by us. ABLIKIM 10A reports $B(\chi_{c0} \rightarrow \eta\eta) = (3.44 \pm 0.10 \pm 0.24 \pm 0.13) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.4 \pm 0.4)\%$.
- ² Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow \eta\eta) = (3.18 \pm 0.13 \pm 0.31 \pm 0.16) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.
- ³ Superseded by ASNER 09. Calculated by us. The value of $B(\chi_{c0}(1P) \rightarrow \eta\eta)$ reported by ADAMS 07 was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.22 \pm 0.11 \pm 0.46)\%$ (ATHAR 04).

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow \eta\eta)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{36}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{42}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.85 ± 0.05 OUR FIT			
0.578 ± 0.241 ± 0.158	BAI	03C BES	$\psi(2S) \rightarrow \gamma\eta\eta$

NODE=M056B11;LINKAGE=AB

NODE=M056B11;LINKAGE=AS

NODE=M056B11;LINKAGE=AD

NODE=M056B10
NODE=M056B10

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{42}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{42}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.92 ± 0.28 OUR FIT				
5.97 ± 0.07 ± 0.32	8.1k	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K^+K^-$

NODE=M056B23
NODE=M056B23

- ¹ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow K^+K^-) = (6.47 \pm 0.08 \pm 0.35 \pm 0.32) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B23;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K^+K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{42}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{42}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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	$\psi(2S) \rightarrow \gamma K^+K^-$

NODE=M056B9
NODE=M056B9

- ¹ Calculated by us. The value for $B(\chi_{c0} \rightarrow K^+K^-)$ reported by BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

NODE=M056B9;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{43}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{43}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10 ± 0.16 OUR FIT				
3.18 ± 0.17 OUR AVERAGE				
3.22 ± 0.07 ± 0.17	2.1k	¹ ASNER	09 CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$
3.02 ± 0.19 ± 0.33	322	ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M056B12
NODE=M056B12

- ¹ Calculated by us. ASNER 09 reports $B(\chi_{c0} \rightarrow K_S^0 K_S^0) = (3.49 \pm 0.08 \pm 0.18 \pm 0.17) \times 10^{-3}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.22 \pm 0.11 \pm 0.46)\%$.

NODE=M056B12;LINKAGE=AS

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow K_S^0 K_S^0)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{43}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{43}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.9 ± 0.5 OUR FIT			
5.6 ± 0.8 ± 1.3	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma K_S^0 K_S^0$

NODE=M056B13
NODE=M056B13

- ¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow K_S^0 K_S^0)$ 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=M056B13;LINKAGE=BA

$$\frac{\Gamma(\chi_{c0}(1P) \rightarrow 2(\pi^+\pi^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)} \times \frac{\Gamma_{11}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{11}/\Gamma \times \Gamma_{153}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
6.6 ± 0.5 OUR FIT			
6.9 ± 2.4 OUR AVERAGE			Error includes scale factor of 3.8.

NODE=M056B4
NODE=M056B4

- 4.4 ± 0.1 ± 0.9 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c0}$
- 9.3 ± 0.9 ² TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c0}$

NODE=M056B;LINKAGE=B2

- 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 98D].

- 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=M056B;LINKAGE=J1

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_8 / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

1.78 ± 0.14 OUR FIT**1.64 ± 0.05 ± 0.2**

ABLIKIM

05Q

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ NODE=M056B18
NODE=M056B18

$$\Gamma(\chi_{c0}(1P) \rightarrow \pi^+ \pi^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_8 / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

5.1 ± 0.4 OUR 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

 $\psi(2S) \rightarrow \gamma \chi_{c0}$ NODE=M056B19
NODE=M056B19

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;LINKAGE=TA

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{51} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

2.76 ± 0.28 OUR FIT**3.20 ± 0.11 ± 0.41**

278

¹ ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M056B14
NODE=M056B14

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;LINKAGE=AB

$$\Gamma(\chi_{c0}(1P) \rightarrow K^+ K^- K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{51} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

8.0 ± 0.8 OUR FIT**6.1 ± 0.8 ± 0.9**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M056B15
NODE=M056B15

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 98D].

NODE=M056B15;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{56} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

0.78 ± 0.07 OUR FIT**0.78 ± 0.08 OUR AVERAGE**

0.77 ± 0.03 ± 0.08

612

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma \text{ hadrons}$

0.86 ± 0.19 ± 0.12

26

² ABLIKIM

06T

BES2

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M056B16
NODE=M056B16

¹ Calculated by us. The value of $B(\chi_{c0} \rightarrow \phi \phi)$ reported by ABLIKIM 11K was derived using $B(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) = (9.62 \pm 0.31)\%$.

NODE=M056B16;LINKAGE=AL

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;LINKAGE=AB

$$\Gamma(\chi_{c0}(1P) \rightarrow \phi \phi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{56} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.25 ± 0.21 OUR FIT**2.6 ± 1.0 ± 1.1**¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma 2K^+ 2K^-$ NODE=M056B17
NODE=M056B17

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;LINKAGE=BA

$$\Gamma(\chi_{c0}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c0}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{81} / \Gamma \times \Gamma_{153}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.45 ± 0.17 ± 0.19

493

¹ ABLIKIM

19BB

BES3

 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$ NODE=M056B24
NODE=M056B24

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;LINKAGE=A

$\chi_{c0}(1P)$ REFERENCES

NODE=M056

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
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
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
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
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 " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M055

NODE=M055

NODE=M055M

NODE=M055M

 $\chi_{c1}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.67 ± 0.05 OUR AVERAGE		Error includes scale factor of 1.2.		
3508.4 ± 1.9 ± 0.7	460	¹ AAIJ	17BB LHCB	$p\bar{p} \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3510.71 ± 0.04 ± 0.09	4.8k	² AAIJ	17BI LHCB	$\chi_{c1} \rightarrow J/\psi \mu^+ \mu^-$
3510.30 ± 0.14 ± 0.16		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$
3510.719 ± 0.051 ± 0.019		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
3509.4 ± 0.9		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3510.60 ± 0.087 ± 0.019	513	³ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+ e^- \gamma$
3511.3 ± 0.4 ± 0.4	30	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+ e^- X$
3512.3 ± 0.3 ± 4.0		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 ± 1.7	91	⁵ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3510.4 ± 0.6		OREGLIA	82 CBAL	$e^+ e^- \rightarrow J/\psi 2\gamma$
3510.1 ± 1.1	254	⁶ HIMEL	80 MRK2	$e^+ e^- \rightarrow J/\psi 2\gamma$
3509 ± 11	21	BRANDELIK	79B DASP	$e^+ e^- \rightarrow J/\psi 2\gamma$
3507 ± 3		⁶ BARTEL	78B CNTR	$e^+ e^- \rightarrow J/\psi 2\gamma$
3505.0 ± 4 ± 4		^{6,7} TANENBAUM	78 MRK1	$e^+ e^-$
3513 ± 7	367	⁶ BIDDICK	77 CNTR	$\psi(2S) \rightarrow \gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3500 ± 10	40	TANENBAUM	75 MRK1	Hadrons γ

OCCUR=2

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

- 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.

 $\chi_{c1}(1P)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 ± 0.04 OUR FIT					
0.88 ± 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 ± 0.045 ± 0.026			ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+ e^- \gamma$
0.87 ± 0.11 ± 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

NODE=M055W

NODE=M055W;LINKAGE=AN

 $\chi_{c1}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level

NODE=M055215;NODE=M055

Hadronic decays

			NODE=M055;CLUMP=A	
Г ₁	$3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2	DESIG=6
Г ₂	$2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		DESIG=5
Г ₃	$\pi^+\pi^-\pi^0\pi^0$	$(1.19 \pm 0.15) \%$		DESIG=51
Г ₄	$\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.45 \pm 0.24) \%$		DESIG=52
Г ₅	$\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		DESIG=9
Г ₆	$4\pi^0$	$(5.4 \pm 0.8) \times 10^{-4}$		DESIG=60
Г ₇	$\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		DESIG=7
Г ₈	$K^+K^-\pi^0\pi^0$	$(1.12 \pm 0.27) \times 10^{-3}$		DESIG=53
Г ₉	$K^+K^-\pi^+\pi^-\pi^0$	$(1.15 \pm 0.13) \%$		DESIG=79
Г ₁₀	$K_S^0 K^\pm \pi^\mp \pi^+\pi^-$	$(7.5 \pm 0.8) \times 10^{-3}$		DESIG=84
Г ₁₁	$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(8.6 \pm 1.4) \times 10^{-3}$		DESIG=55
Г ₁₂	$\rho^-K^+\bar{K}^0 + \text{c.c.}$	$(5.0 \pm 1.2) \times 10^{-3}$		DESIG=56
Г ₁₃	$K^*(892)^0\bar{K}^0\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.3 \pm 0.6) \times 10^{-3}$		DESIG=57
Г ₁₄	$K^+K^-\eta\pi^0$	$(1.12 \pm 0.34) \times 10^{-3}$		DESIG=58
Г ₁₅	$\pi^+\pi^-K_S^0K_S^0$	$(6.9 \pm 2.9) \times 10^{-4}$		DESIG=28
Г ₁₆	$K^+K^-\eta$	$(3.2 \pm 1.0) \times 10^{-4}$		DESIG=42
Г ₁₇	$\bar{K}^0K^+\pi^- + \text{c.c.}$	$(7.0 \pm 0.6) \times 10^{-3}$		DESIG=17
Г ₁₈	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(10 \pm 4) \times 10^{-4}$		DESIG=32
Г ₁₉	$K^*(892)^+K^- + \text{c.c.}$	$(1.4 \pm 0.6) \times 10^{-3}$		DESIG=33
Г ₂₀	$K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%	DESIG=34
Г ₂₁	$K_J^*(1430)^+K^- + \text{c.c.} \rightarrow K_S^0K^+\pi^- + \text{c.c.}$	$< 2.1 \times 10^{-3}$	CL=90%	DESIG=35
Г ₂₂	$K^+K^-\pi^0$	$(1.81 \pm 0.24) \times 10^{-3}$		DESIG=38
Г ₂₃	$\eta\pi^+\pi^-$	$(4.62 \pm 0.23) \times 10^{-3}$		DESIG=31
Г ₂₄	$a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(3.2 \pm 0.4) \times 10^{-3}$	S=2.2	DESIG=36
Г ₂₅	$a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(1.76 \pm 0.24) \times 10^{-4}$		DESIG=93
Г ₂₆	$a_2(1700)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(4.6 \pm 0.7) \times 10^{-5}$		DESIG=96
Г ₂₇	$f_2(1270)\eta \rightarrow \eta\pi^+\pi^-$	$(3.5 \pm 0.6) \times 10^{-4}$		DESIG=94
Г ₂₈	$f_4(2050)\eta \rightarrow \eta\pi^+\pi^-$	$(2.5 \pm 0.9) \times 10^{-5}$		DESIG=95
Г ₂₉	$\pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 5 \times 10^{-5}$	CL=90%	DESIG=97
Г ₃₀	$\pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=98
Г ₃₁	$\pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 8 \times 10^{-6}$	CL=90%	DESIG=99
Г ₃₂	$f_2(1270)\eta$	$(6.7 \pm 1.1) \times 10^{-4}$		DESIG=37
Г ₃₃	$\pi^+\pi^-\eta'$	$(2.2 \pm 0.4) \times 10^{-3}$		DESIG=44
Г ₃₄	$K^+K^-\eta'(958)$	$(8.8 \pm 0.9) \times 10^{-4}$		DESIG=85
Г ₃₅	$K_0^*(1430)^+K^- + \text{c.c.}$	$(6.4 \pm_{-2.8}^{+2.2}) \times 10^{-4}$		DESIG=86
Г ₃₆	$f_0(980)\eta'(958)$	$(1.6 \pm_{-0.7}^{+1.4}) \times 10^{-4}$		DESIG=87
Г ₃₇	$f_0(1710)\eta'(958)$	$(7 \pm_{-5}^{+7}) \times 10^{-5}$		DESIG=88
Г ₃₈	$f_2'(1525)\eta'(958)$	$(9 \pm 6) \times 10^{-5}$		DESIG=89
Г ₃₉	$\pi^0 f_0(980) \rightarrow \pi^0\pi^+\pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$		DESIG=61
Г ₄₀	$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		DESIG=10
Г ₄₁	$K^*(892)^0\bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$		DESIG=21
Г ₄₂	$K^+K^-K_S^0K_S^0$	$< 4 \times 10^{-4}$	CL=90%	DESIG=29
Г ₄₃	$K_S^0K_S^0K_S^0K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$		DESIG=102
Г ₄₄	$K^+K^-K^+K^-$	$(5.4 \pm 1.1) \times 10^{-4}$		DESIG=14
Г ₄₅	$K^+K^-\phi$	$(4.1 \pm 1.5) \times 10^{-4}$		DESIG=30
Г ₄₆	$\bar{K}^0K^+\pi^-\phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		DESIG=90
Г ₄₇	$K^+K^-\pi^0\phi$	$(1.62 \pm 0.30) \times 10^{-3}$		DESIG=91
Г ₄₈	$\phi\pi^+\pi^-\pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		DESIG=82
Г ₄₉	$\omega\omega$	$(5.7 \pm 0.7) \times 10^{-4}$		DESIG=66
Г ₅₀	ωK^+K^-	$(7.8 \pm 0.9) \times 10^{-4}$		DESIG=81
Г ₅₁	$\omega\phi$	$(2.7 \pm 0.4) \times 10^{-5}$		DESIG=67
Г ₅₂	$\phi\phi$	$(4.2 \pm 0.5) \times 10^{-4}$		DESIG=68

Γ ₅₃	$\phi\phi\eta$	$(3.0 \pm 0.5) \times 10^{-4}$		DESIG=104
Γ ₅₄	$p\bar{p}$	$(7.60 \pm 0.34) \times 10^{-5}$		DESIG=11
Γ ₅₅	$p\bar{p}\pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$		DESIG=39
Γ ₅₆	$p\bar{p}\eta$	$(1.45 \pm 0.25) \times 10^{-4}$		DESIG=43
Γ ₅₇	$p\bar{p}\omega$	$(2.12 \pm 0.31) \times 10^{-4}$		DESIG=59
Γ ₅₈	$p\bar{p}\phi$	$< 1.7 \times 10^{-5}$	CL=90%	DESIG=65
Γ ₅₉	$p\bar{p}\pi^+\pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		DESIG=8
Γ ₆₀	$p\bar{p}\pi^0\pi^0$	$< 5 \times 10^{-4}$	CL=90%	DESIG=54
Γ ₆₁	$p\bar{p}K^+K^-$ (non-resonant)	$(1.27 \pm 0.22) \times 10^{-4}$		DESIG=62
Γ ₆₂	$p\bar{p}K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	DESIG=25
Γ ₆₃	$p\bar{n}\pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		DESIG=74
Γ ₆₄	$\bar{p}n\pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		DESIG=75
Γ ₆₅	$p\bar{n}\pi^-\pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		DESIG=76
Γ ₆₆	$\bar{p}n\pi^+\pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$		DESIG=77
Γ ₆₇	$\Lambda\bar{\Lambda}$	$(1.14 \pm 0.11) \times 10^{-4}$		DESIG=19
Γ ₆₈	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		DESIG=24
Γ ₆₉	$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$(2.5 \pm 0.6) \times 10^{-4}$		DESIG=69
Γ ₇₀	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=70
Γ ₇₁	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	DESIG=71
Γ ₇₂	$K^+\bar{p}\Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2	DESIG=40
Γ ₇₃	$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		DESIG=106
Γ ₇₄	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		DESIG=63
Γ ₇₅	$\Lambda(1520)\bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%	DESIG=64
Γ ₇₆	$\Sigma^0\bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$		DESIG=48
Γ ₇₇	$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(1.53 \pm 0.12) \times 10^{-4}$		DESIG=105
Γ ₇₈	$\Sigma^+\bar{\Sigma}^-$	$(3.6 \pm 0.7) \times 10^{-5}$		DESIG=49
Γ ₇₉	$\Sigma^-\bar{\Sigma}^+$	$(5.7 \pm 1.5) \times 10^{-5}$		DESIG=107
Γ ₈₀	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%	DESIG=72
Γ ₈₁	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	DESIG=73
Γ ₈₂	$K^-\bar{\Lambda}\Xi^+ + \text{c.c.}$	$(1.35 \pm 0.24) \times 10^{-4}$		DESIG=92
Γ ₈₃	$\Xi^0\Xi^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=50
Γ ₈₄	$\Xi^-\Xi^+$	$(8.0 \pm 2.1) \times 10^{-5}$		DESIG=26
Γ ₈₅	$\pi^+\pi^- + K^+K^-$	$< 2.1 \times 10^{-3}$		DESIG=23
Γ ₈₆	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	DESIG=27
Γ ₈₇	$\eta_c\pi^+\pi^-$	$< 3.2 \times 10^{-3}$	CL=90%	DESIG=83

Radiative decays

Γ ₈₈	$\gamma J/\psi(1S)$	$(34.3 \pm 1.0) \%$		NODE=M055;CLUMP=B DESIG=1
Γ ₈₉	$\gamma\rho^0$	$(2.16 \pm 0.17) \times 10^{-4}$		DESIG=45
Γ ₉₀	$\gamma\omega$	$(6.8 \pm 0.8) \times 10^{-5}$		DESIG=46
Γ ₉₁	$\gamma\phi$	$(2.4 \pm 0.5) \times 10^{-5}$		DESIG=47
Γ ₉₂	$\gamma\gamma$	$< 6.3 \times 10^{-6}$	CL=90%	DESIG=4
Γ ₉₃	$e^+e^- J/\psi(1S)$	$(3.46 \pm 0.22) \times 10^{-3}$		DESIG=100
Γ ₉₄	$\mu^+\mu^- J/\psi(1S)$	$(2.33 \pm 0.29) \times 10^{-4}$		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 84 branching ratios uses 248 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 378.1$ for 199 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_{44}	3				
x_{54}	4	2			
x_{67}	7	3	4		
x_{88}	23	9	2	20	
Γ	-12	-5	-63	-10	-41
	x_{17}	x_{44}	x_{54}	x_{67}	x_{88}

$\chi_{c1}(1P)$ PARTIAL WIDTHS

$$\chi_{c1}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{54} \Gamma_{88} / \Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

21.9±0.8 OUR FIT**21.4±0.9 OUR AVERAGE**

21.5±0.5±0.8

¹ ANDREOTTI 05A E835 $p\bar{p} \rightarrow e^+ e^- \gamma$

21.4±1.5±2.2

^{1,2} ARMSTRONG 92 E760 $\bar{p}p \rightarrow e^+ e^- \gamma$ 19.9^{+4.4}_{-4.0}¹ BAGLIN 86B SPEC $\bar{p}p \rightarrow e^+ e^- X$ ¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010$.² Recalculated by ANDREOTTI 05A.

NODE=M055220

NODE=M055223

NODE=M055G1
NODE=M055G1NODE=M055G;LINKAGE=7A
NODE=M055G;LINKAGE=AN $\chi_{c1}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS

$$\Gamma(3(\pi^+ \pi^-)) / \Gamma_{\text{total}} \quad \Gamma_1 / \Gamma$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT

5.8±1.4 OUR EVALUATION Error includes scale factor of 1.2. Treating systematic error as correlated.**5.8±1.1 OUR AVERAGE**

5.4±0.7±0.9

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c1}$

16.0±5.9±0.8

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=M055225

NODE=M055305

NODE=M055R6
NODE=M055R6

→ UNCHECKED ←

NODE=M055R;LINKAGE=X2

$$\Gamma(2(\pi^+ \pi^-)) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

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

¹ BAI 99B BES $\psi(2S) \rightarrow \gamma \chi_{c1}$

12.5±4.2±0.6

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=M055R4
NODE=M055R4

→ UNCHECKED ←

NODE=M055R4;LINKAGE=X2

$$\Gamma(\pi^+ \pi^- \pi^0 \pi^0) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.19±0.15±0.03 604.7 ¹ HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$ ¹ HE 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

$$\Gamma(\rho^+ \pi^- \pi^0 + \text{c.c.}) / \Gamma_{\text{total}} \quad \Gamma_4 / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT

1.45±0.24±0.04 712.3 ^{1,2} HE 08B CLEO $e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$ ¹ HE 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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=M055R36
NODE=M055R36

NODE=M055R36;LINKAGE=HE

NODE=M055R36;LINKAGE=OC

$$\Gamma(\rho^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_5 / \Gamma$$

VALUE (units 10 ⁻³)	DOCUMENT ID	TECN	COMMENT

3.9±3.5 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$ 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=M055R8
NODE=M055R8

NODE=M055R;LINKAGE=T

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±0.8±0.1	608	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
¹ ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_7/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	¹ BAI	99B BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
7.3±3.0±0.4	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=M055R5
 NODE=M055R5

→ UNCHECKED ←

NODE=M055R5;LINKAGE=X2

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.12±0.27±0.03	45.1	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
¹ HE 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(K^+K^-\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_9/Γ

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 $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.				

NODE=M055R00
 NODE=M055R00

NODE=M055R00;LINKAGE=A

 $\Gamma(K_S^0 K^\pm \pi^\mp \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

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 $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.				

NODE=M055R60
 NODE=M055R60

NODE=M055R60;LINKAGE=A

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

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{12}/Γ

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(K^*(892)^0\bar{K}^0\pi^0 \rightarrow K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

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

VALUE (%)	EVTs	DOCUMENT ID	TECN	COMMENT
0.112±0.034±0.003	141.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M055R42
NODE=M055R42

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R42;LINKAGE=HE

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

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
6.9±2.9±0.2	19.8±7.7	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

NODE=M055R05
NODE=M055R05

¹ ABLIKIM 050 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R05;LINKAGE=AB

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.2±1.0±0.1	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M055R25
NODE=M055R25

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R25;LINKAGE=AT

 $\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
7.0±0.6 OUR FIT	

NODE=M055R17
NODE=M055R17

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
0.98±0.37±0.02	22	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R09
NODE=M055R09

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R09;LINKAGE=AB

 $\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.43±0.65±0.03	27	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R10
NODE=M055R10

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R10;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_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8 \times 10^{-4}$	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R12
NODE=M055R12

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;LINKAGE=AB

 $\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.1 \times 10^{-3}$	90	¹ ABLIKIM	06R BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R13
NODE=M055R13

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;LINKAGE=AB

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{22}/Γ NODE=M055R20
NODE=M055R20**1.81±0.24±0.04**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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R20;LINKAGE=AT

 $\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{23}/Γ NODE=M055R08
NODE=M055R08**4.62±0.23 OUR AVERAGE**

4.58±0.23±0.11

^{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

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=AT

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R08;LINKAGE=AB

 $\Gamma(a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{24}/Γ NODE=M055R15
NODE=M055R15**3.2 ±0.4 OUR AVERAGE** Error includes scale factor of 2.2.

3.33±0.19±0.08

^{1,2} ABLIKIM

17K

BES3

 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

1.79±0.63±0.04

58

³ ABLIKIM

06R

BES2

 $\psi(2S) \rightarrow \gamma \chi_{c1}$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R15;LINKAGE=AB

 $\Gamma(a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 Γ_{25}/Γ NODE=M055R72
NODE=M055R72**0.176±0.023±0.004**^{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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R72;LINKAGE=A
NODE=M055R72;LINKAGE=B $\Gamma(a_2(1700)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

 Γ_{26}/Γ NODE=M055R75
NODE=M055R75**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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R75;LINKAGE=A
NODE=M055R75;LINKAGE=B

$\Gamma(f_2(1270)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{27}/Γ

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

3.5±0.6±0.1

1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R73
NODE=M055R73

OCCUR=2

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R73;LINKAGE=A
NODE=M055R73;LINKAGE=D

$\Gamma(f_4(2050)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{28}/Γ

VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

2.5±0.9±0.1

1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R74
NODE=M055R74

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R74;LINKAGE=A
NODE=M055R74;LINKAGE=B

$\Gamma(\pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{29}/Γ

VALUE
<5 × 10⁻⁵

CL%

DOCUMENT ID

TECN

COMMENT

1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R76
NODE=M055R76

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;LINKAGE=A
NODE=M055R76;LINKAGE=B

$\Gamma(\pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{30}/Γ

VALUE
<1.5 × 10⁻⁵

CL%

DOCUMENT ID

TECN

COMMENT

1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R77
NODE=M055R77

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;LINKAGE=A
NODE=M055R77;LINKAGE=B

$\Gamma(\pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$

Γ_{31}/Γ

VALUE
<8 × 10⁻⁶

CL%

DOCUMENT ID

TECN

COMMENT

1,2 ABLIKIM 17K BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M055R78
NODE=M055R78

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;LINKAGE=A
NODE=M055R78;LINKAGE=B

$\Gamma(f_2(1270)\eta) / \Gamma_{\text{total}}$

Γ_{32}/Γ

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 $\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R16
NODE=M055R16

¹ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

²From an amplitude analysis using an isobar model.

³ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R16;LINKAGE=B

NODE=M055R16;LINKAGE=D
NODE=M055R16;LINKAGE=C

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

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

$2.2 \pm 0.4 \pm 0.1$

¹ATHAR

07

CLEO

$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ATHAR 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

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

VALUE (units 10^{-4})

EVTs

DOCUMENT ID

TECN

COMMENT

8.75 ± 0.87

310

¹ABLIKIM

14J

BES3

$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹Derived 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
NODE=M055R64

NODE=M055R64;LINKAGE=A

$\Gamma(K^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

$6.41 \pm 0.57^{+2.09}_{-2.71}$

¹ABLIKIM

14J

BES3

$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R65
NODE=M055R65

NODE=M055R65;LINKAGE=A

$\Gamma(f_0(980)\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

$1.65 \pm 0.47^{+1.32}_{-0.56}$

¹ABLIKIM

14J

BES3

$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R66
NODE=M055R66

NODE=M055R66;LINKAGE=A

$\Gamma(f_0(1710)\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

$0.71 \pm 0.22^{+0.68}_{-0.48}$

¹ABLIKIM

14J

BES3

$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R67
NODE=M055R67

NODE=M055R67;LINKAGE=A

$\Gamma(f'_2(1525)\eta'(958))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

$0.92 \pm 0.23^{+0.55}_{-0.51}$

¹ABLIKIM

14J

BES3

$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

NODE=M055R68
NODE=M055R68

NODE=M055R68;LINKAGE=A

$\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})

CL%

DOCUMENT ID

TECN

COMMENT

0.35 ± 0.09

ABLIKIM

18D

BES3

$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

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

<6

90

¹ABLIKIM

11D

BES3

$\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

¹ABLIKIM 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
NODE=M055R18

NODE=M055R18;LINKAGE=BR

$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

32 ± 21

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=M055R9
NODE=M055R9

NODE=M055R9;LINKAGE=T

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.44±0.36±0.03	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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(K^+ K^- K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}$ Γ_{42}/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 $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

NODE=M055R06;LINKAGE=AB

 $\Gamma(K_S^0 \bar{K}_S^0 K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}$ Γ_{43}/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 $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 \bar{K}_S^0 K_S^0 \bar{K}_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (3.4 \pm 0.9 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
0.54±0.11 OUR FIT	

NODE=M055R14
 NODE=M055R14

 $\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{45}/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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{46}/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_{47}/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_{48}/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_{49}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.7±0.7±0.1	597	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma \text{ hadrons}$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{50}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.78±0.04±0.08	628	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

NODE=M055R61
NODE=M055R61

NODE=M055R61;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{51}/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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{52}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±0.5±0.1	366	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

NODE=M055R51;LINKAGE=AL

 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.0±0.4±0.2	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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$.

NODE=M055R85
NODE=M055R85

NODE=M055R85;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.760±0.034 OUR FIT	

NODE=M055R11
NODE=M055R11

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{55}/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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{56}/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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{57}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.212±0.030±0.005	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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{58}/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_{59}/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_{60}/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_{61}/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.27±0.22±0.03	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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{62}/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_{63}/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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.9 \pm 0.5 \pm 0.1$	1625	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R57
NODE=M055R57

NODE=M055R57;LINKAGE=AL

$\Gamma(p\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$10.3 \pm 1.1 \pm 0.2$	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-\pi^0$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R58
NODE=M055R58

NODE=M055R58;LINKAGE=AL

$\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$10.1 \pm 1.1 \pm 0.2$	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma \bar{p}n\pi^+\pi^0$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R59
NODE=M055R59

NODE=M055R59;LINKAGE=AL

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.14 ± 0.11 OUR FIT	

NODE=M055R23
NODE=M055R23

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$29 \pm 5 \pm 1$		105	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. • • •					
<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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) (9.1 \pm 0.6)\%$.					

NODE=M055R01
NODE=M055R01

NODE=M055R01;LINKAGE=AL

NODE=M055R01;LINKAGE=AB

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-(\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$25 \pm 6 \pm 1$	13	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}\pi^+\pi^-$
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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M055R19
NODE=M055R19

NODE=M055R19;LINKAGE=AL

$\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-4}$	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+\bar{\Lambda}\pi^-$
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
NODE=M055R52

NODE=M055R52;LINKAGE=AL

$\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$
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
NODE=M055R53

NODE=M055R53;LINKAGE=AL

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE	Error includes scale factor of 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

NODE=M055R22;LINKAGE=A

NODE=M055R22;LINKAGE=AB

NODE=M055R22;LINKAGE=LB
NODE=M055R22;LINKAGE=AT

 $\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 0.7 \pm 0.1$	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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.71 \pm 0.44 \pm 0.04$	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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(\Lambda(1520) \bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9 \times 10^{-5}$	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

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{78}/Γ

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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

 $\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{79}/Γ

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

$5.7 \pm 1.4 \pm 0.6$		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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$.

NODE=M055R87
NODE=M055R87

NODE=M055R87;LINKAGE=A

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{80}/Γ

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

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{81}/Γ

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

 $\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{82}/Γ

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

$1.35 \pm 0.24 \pm 0.03$	49	¹ ABLIKIM	15I BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$

¹ ABLIKIM 15I reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.32 \pm 0.20 \pm 0.12) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R71
NODE=M055R71

NODE=M055R71;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT

$< 6 \times 10^{-5}$	90	1.7 ± 2.4	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$

¹ 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
NODE=M055R34

NODE=M055R34;LINKAGE=NA

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{84}/Γ

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

$0.80 \pm 0.21 \pm 0.02$	16.4 ± 4.3		¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$

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

< 3.4	90		² ABLIKIM	06D BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

NODE=M055R03
NODE=M055R03

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c1} \gamma) (9.1 \pm 0.6)\%$.

NODE=M055R03;LINKAGE=NA

$[\Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-)] / \Gamma_{\text{total}} \quad \Gamma_{85} / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<21 \times 10^{-4}$		¹ FELDMAN	77 MRK1	$\psi(2S) \rightarrow \gamma \chi_{c1}$

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

$<38 \times 10^{-4}$	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=M055R03;LINKAGE=AB

NODE=M055R2
NODE=M055R2

NODE=M055R2;LINKAGE=T

$\Gamma(K_S^0 K_S^0) / \Gamma_{\text{total}} \quad \Gamma_{86} / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

$<6 \times 10^{-5}$	90	¹ ABLIKIM	05O BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$

¹ ABLIKIM 05O 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

$\Gamma(\eta_c \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{87} / \Gamma$

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

————— RADIATIVE DECAYS —————

$\Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_{88} / \Gamma$

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

34.3 ± 1.0 OUR FIT

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

$34.75 \pm 0.11 \pm 1.70$	1.9M	¹ ABLIKIM	17U BES3	$e^+ e^- \rightarrow \gamma X$

$37.9 \pm 0.8 \pm 2.1$		² ADAM	05A CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Not independent from $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))$ and the product $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))$ also measured in ABLIKIM 17U.

² Uses $B(\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow \gamma \gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma \chi_{c1})$ from ATHAR 04.

NODE=M055R1
NODE=M055R1

NODE=M055R1;LINKAGE=A

NODE=M055R1;LINKAGE=AD

$\Gamma(\gamma \rho^0) / \Gamma_{\text{total}} \quad \Gamma_{89} / \Gamma$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT

216 ± 17 OUR AVERAGE

$215 \pm 22 \pm 5$	432 ± 25	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

$217 \pm 24 \pm 5$	186 ± 15	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma \gamma \rho^0$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R29
NODE=M055R29

NODE=M055R29;LINKAGE=AB

NODE=M055R29;LINKAGE=BE

$\Gamma(\gamma\omega)/\Gamma_{\text{total}}$
 Γ_{90}/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 $\psi(2S) \rightarrow \gamma\gamma\omega$

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M055R30
 NODE=M055R30

NODE=M055R30;LINKAGE=AB

NODE=M055R30;LINKAGE=BE

 $\Gamma(\gamma\phi)/\Gamma_{\text{total}}$
 Γ_{91}/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 $\psi(2S) \rightarrow \gamma\gamma\phi$

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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
 NODE=M055R31

NODE=M055R31;LINKAGE=AB

NODE=M055R31;LINKAGE=BE

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$
 Γ_{92}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

< **6.3 × 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 × 10⁻⁵ 90 ECKLUND 08A CLEO $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow 3\gamma$

<150 × 10⁻⁵ 90 ¹ YAMADA 77 DASP $e^+e^- \rightarrow 3\gamma$

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=M055R3
 NODE=M055R3

NODE=M055R;LINKAGE=T1

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$
 Γ_{93}/Γ

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

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

3.65 ± 0.23 ± 0.09 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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_{93}/Γ_{88}

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

10.1 ± 0.3 ± 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

 $\Gamma(\mu^+\mu^- J/\psi(1S))/\Gamma(e^+e^- J/\psi(1S))$
 Γ_{94}/Γ_{93}

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

6.73 ± 0.51 ± 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

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{54}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M055B1
NODE=M055B1VALUE (units 10^{-5})

DOCUMENT ID

TECN

COMMENT

2.14±0.10 OUR FIT**1.1 ±1.0**¹ BAI

98I

BES

 $\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\bar{p}p$

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=M055B;LINKAGE=J2

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{67}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M055B10
NODE=M055B10VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

11.1±1.1 OUR FIT**10.9±1.1 OUR AVERAGE**

11.2±1.0±0.9

136

¹ ABLIKIM

13H

BES3

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

10.5±1.6±0.6

46 ± 7

² NAIK

08

CLEO

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ 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;LINKAGE=AB

² 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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

NODE=M055B10;LINKAGE=NA

$$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{67}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M055B11
NODE=M055B11VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

3.20±0.30 OUR FIT**7.1 $^{+2.8}_{-2.4}$ ±1.3**9.0 $^{+3.5}_{-3.1}$ ¹ BAI

03E

BES

 $\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports $[B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c1}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.52}_{-0.46} \pm 0.25)\%$. 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;LINKAGE=BA

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{88}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

NODE=M055B2
NODE=M055B2VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

3.34 ±0.06 OUR FIT**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 $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.

NODE=M055B2;LINKAGE=A

² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M055B;LINKAGE=3Q

³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

NODE=M055B;LINKAGE=2Q

⁴ Assumes isotropic gamma distribution.

NODE=M055B;LINKAGE=EA

⁵ Superseded by ABLIKIM 17N.

NODE=M055B2;LINKAGE=B

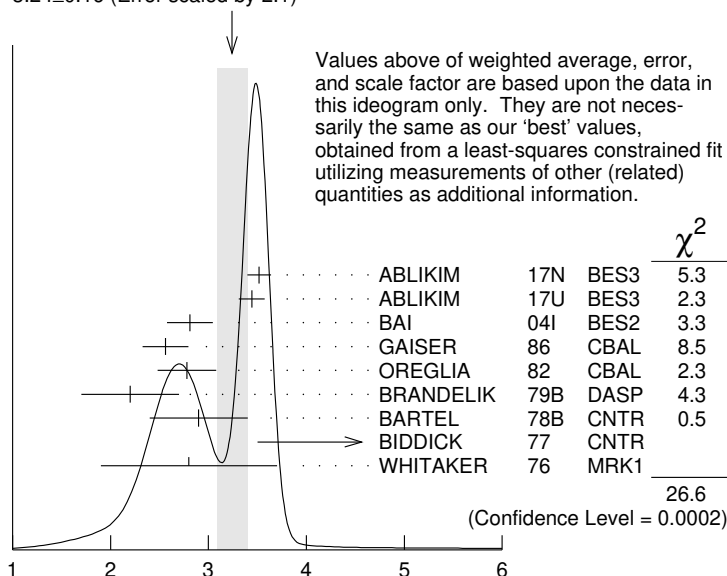
⁶ Not independent from other measurements of MENDEZ 08.

NODE=M055B2;LINKAGE=ME

⁷ Not independent from other values reported by ADAM 05A.

NODE=M055B;LINKAGE=AD

WEIGHTED AVERAGE
3.24±0.16 (Error scaled by 2.1)



$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-2})$$

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\Gamma_{88}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_9^{\psi(2S)} = \Gamma_{88}/\Gamma \times \Gamma_{154}^{\psi(2S)}/(\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.343\Gamma_{154}^{\psi(2S)} + 0.190\Gamma_{155}^{\psi(2S)})$$

NODE=M055B7

NODE=M055B7

NODE=M055B7

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

5.43±0.10 OUR FIT

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

5.70±0.04±0.15	24.9k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.77±0.10±0.12	3.7k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M055B7;LINKAGE=ME

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{88}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

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

9.63±0.17 OUR 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=M055B;LINKAGE=AB

NODE=M055B;LINKAGE=J3

NODE=M055B3;LINKAGE=AD

$$\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

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

6.8±0.5 OUR 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 $B(\chi_{c1} \rightarrow K^0 K^+ \pi^- + \text{c.c.})$ 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

NODE=M055B16;LINKAGE=AT

NODE=M055B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{17}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

19.6 ± 1.6 OUR 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

NODE=M055B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{44}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

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

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{44}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

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

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \quad \frac{\Gamma_{54}/\Gamma \times \Gamma_{154}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

7.41 ± 0.35 OUR FIT**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 $^{+1.4}_{-1.3}$ ± 0.618.2 $^{+5.5}_{-4.9}$

BAI

04F

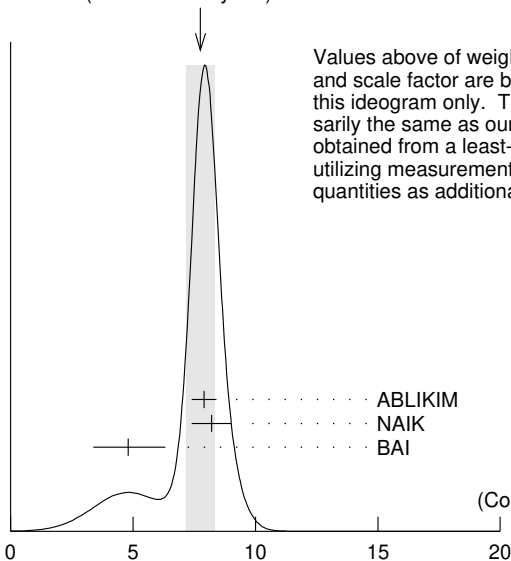
BES

 $\psi(2S) \rightarrow \gamma \chi_{c1}(1P) \rightarrow \gamma p \bar{p}$

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
NODE=M055B6

NODE=M055B6;LINKAGE=NA

WEIGHTED AVERAGE
7.8 ± 0.6 (Error scaled by 1.4)

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
ABLIKIM	13V	BES3	0.1
NAIK	08	CLEO	0.3
BAI	04F	BES	3.8
			4.2
			(Confidence Level = 0.125)

$$\Gamma(\chi_{c1}(1P) \rightarrow p \bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-6})$$

$$\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{77} / \Gamma \times \Gamma_{154}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.49 \pm 0.09 \pm 0.07$	258	¹ ABLIKIM	19BB BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c1} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (1.53 \pm 0.10 \pm 0.08) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 18.

NODE=M055B01
NODE=M055B01

NODE=M055B01;LINKAGE=A

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

NODE=M055240

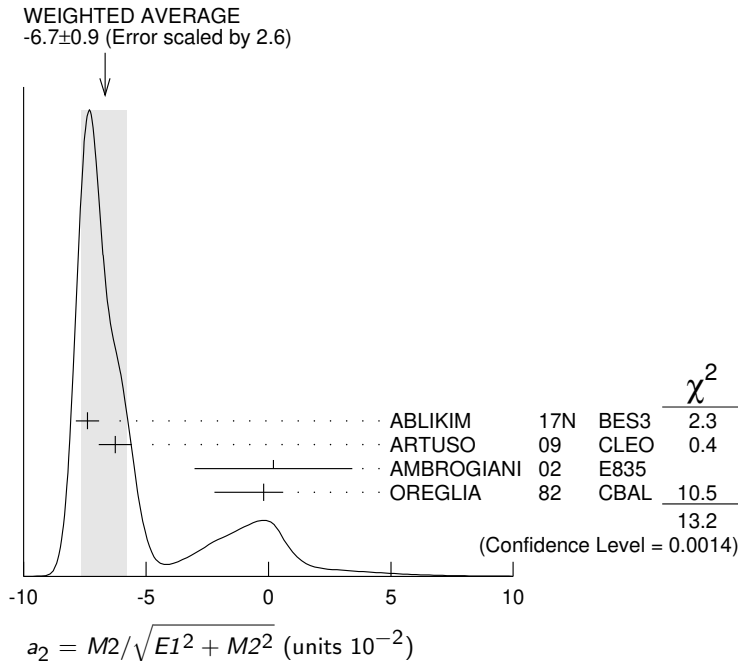
$a_2 = M_2 / \sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055A1
NODE=M055A1

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.		
$-7.40 \pm 0.33 \pm 0.34$	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
$-6.26 \pm 0.63 \pm 0.24$	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
$0.2 \pm 3.2 \pm 0.4$	2090	AMBROGIANI	02 E835	$p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi \gamma$
-0.2 ± 0.8 -2.0	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \chi_{c1} \gamma \rightarrow J/\psi \gamma \gamma$

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

$b_2 = M_2 / \sqrt{E_1^2 + M_2^2}$ Magnetic quadrupole fractional transition amplitude

NODE=M055QB2
NODE=M055QB2

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.4 OUR AVERAGE				
$2.29 \pm 0.39 \pm 0.27$	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
$2.76 \pm 0.73 \pm 0.23$	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

NODE=M055260

$\psi(2S) \rightarrow \gamma \chi_{c1}(1S)$ and $\chi_{c1} \rightarrow \gamma J/\psi(1S)$

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

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
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
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
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
3525.38±0.11 OUR AVERAGE				
3525.31±0.11±0.14	832	¹ ABLIKIM	12N BES3	$\psi(2S) \rightarrow \pi^0 \gamma$ hadrons
3525.40±0.13±0.18	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
3525.20±0.18±0.12	1282	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3525.8 ±0.2 ±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. • • •				
3525.6 ±0.5	92 ⁺²³ ₋₂₂	ADAMS	09 CLEO	$\psi(2S) \rightarrow 2(\pi^+ \pi^- \pi^0)$
3524.4 ±0.6 ±0.4	168 ± 40	³ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
3527 ±8	42	ANTONIAZZI	94 E705	300 $\pi^\pm$, $p\text{Li} \rightarrow J/\psi \pi^0 X$
3526.28±0.18±0.19	59	⁴ ARMSTRONG	92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$
3525.4 ±0.8 ±0.4	5	BAGLIN	86 SPEC	$\bar{p}p \rightarrow J/\psi X$

¹With floating width.

²Combination 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.

³Superseded by DOBBS 08A.

⁴Mass 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=AB

NODE=M144M;LINKAGE=DO

NODE=M144M;LINKAGE=RO

NODE=M144M;LINKAGE=NW

$h_c(1P)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.28±0.22					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.44	90	3679	² 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	$\bar{p}p \rightarrow J/\psi \pi^0$

¹With floating mass.

²The central value is $\Gamma = 0.73 \pm 0.45 \pm 0.28$ MeV.

NODE=M144W

NODE=M144W

NODE=M144W;LINKAGE=AL

NODE=M144W;LINKAGE=AB

$h_c(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $J/\psi(1S)\pi^0$		
Γ_2 $J/\psi(1S)\pi\pi$	not seen	
Γ_3 $J/\psi(1S)\pi^+\pi^-$	< 2.3 $\times 10^{-3}$	90%
Γ_4 $p\bar{p}$	< 1.5 $\times 10^{-4}$	90%
Γ_5 $p\bar{p}\pi^+\pi^-$	(2.9±0.6) $\times 10^{-3}$	
Γ_6 $\pi^+\pi^-\pi^0$	(1.6±0.5) $\times 10^{-3}$	
Γ_7 $2\pi^+2\pi^-\pi^0$	(8.1±1.8) $\times 10^{-3}$	
Γ_8 $3\pi^+3\pi^-\pi^0$	< 9 $\times 10^{-3}$	90%
Γ_9 $K^+K^-\pi^+\pi^-$	< 6 $\times 10^{-4}$	90%

DESIG=1

DESIG=2;OUR EST;→ UNCHECKED ←

DESIG=10

DESIG=3

DESIG=11

DESIG=5

DESIG=6

DESIG=7

DESIG=12

Radiative decays

Γ_{10} $\gamma\eta$	(4.7±2.1) $\times 10^{-4}$
Γ_{11} $\gamma\eta'(958)$	(1.5±0.4) $\times 10^{-3}$
Γ_{12} $\gamma\eta_c(1S)$	(51 ± 6) %

NODE=M144;CLUMP=R

DESIG=9

DESIG=8

DESIG=4

$h_c(1P)$ PARTIAL WIDTHS

NODE=M144220

$h_c(1P) \Gamma(i) \Gamma(\bar{p}p) / \Gamma(\text{total})$

NODE=M144223

 $\Gamma(\gamma h_c(1S)) \times \Gamma(p\bar{p}) / \Gamma_{\text{total}} \quad \Gamma_{12} \Gamma_4 / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M144G1
NODE=M144G1

• • • 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;LINKAGE=AN

 $h_c(1P) \text{ BRANCHING RATIOS}$

NODE=M144225

 $\Gamma(J/\psi(1S)\pi\pi) / \Gamma(J/\psi(1S)\pi^0) \quad \Gamma_2 / \Gamma_1$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M144R1
NODE=M144R1

<0.18	90	ARMSTRONG 92D E760	$\bar{p}p \rightarrow J/\psi \pi^0$

 $\Gamma(J/\psi(1S)\pi^+\pi^-) / \Gamma_{\text{total}} \quad \Gamma_3 / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M144R07
NODE=M144R07

<2.3 × 10⁻³	90	¹ ABLIKIM 18M BES3	$\psi(2S) \rightarrow \pi^0 \pi^+ \pi^- J/\psi$

OCCUR=2

¹ ABLIKIM 18M reports $[\Gamma(h_c(1P) \rightarrow J/\psi(1S)\pi^+\pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] < 2.0 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R07;LINKAGE=B

 $\Gamma(\pi^+\pi^-\pi^0) / \Gamma_{\text{total}} \quad \Gamma_6 / \Gamma$

VALUE (units 10 ⁻³)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M144R01
NODE=M144R01

1.6±0.5±0.2	101	¹ ABLIKIM 19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

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

<2.2	90	² ADAMS 09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (1.38 \pm 0.35 \pm 0.17) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R01;LINKAGE=A

² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow \pi^+\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] < 0.19 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R01;LINKAGE=AD

 $\Gamma(2\pi^+2\pi^-\pi^0) / \Gamma_{\text{total}} \quad \Gamma_7 / \Gamma$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M144R02
NODE=M144R02

0.81±0.18 OUR AVERAGE

0.74±0.14±0.11	254	¹ ABLIKIM 19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

2.2 $^{+0.8}_{-0.6}$ ±0.3	92	² ADAMS 09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+2\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (6.40 \pm 0.81 \pm 0.87) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. 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

² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 2\pi^+2\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] = (1.88^{+0.48+0.47}_{-0.45-0.30}) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M144R02;LINKAGE=AD

 $\Gamma(3\pi^+3\pi^-\pi^0) / \Gamma_{\text{total}} \quad \Gamma_8 / \Gamma$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M144R03
NODE=M144R03

<9 × 10⁻³	90	¹ ABLIKIM 19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$

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

<0.029	90	² ADAMS 09 CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow 3\pi^+3\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] < 7.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R03;LINKAGE=A

² ADAMS 09 reports $[\Gamma(h_c(1P) \rightarrow 3\pi^+3\pi^-\pi^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))] < 2.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = 8.6 \times 10^{-4}$.

NODE=M144R03;LINKAGE=AD

$\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.9 \pm 0.5 \pm 0.4$	230	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$ $= (2.49 \pm 0.27 \pm 0.28) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$ $= (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M144R08
 NODE=M144R08

NODE=M144R08;LINKAGE=A

$\Gamma(K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-4}$	90	¹ ABLIKIM	19AG BES3	$\psi(2S) \rightarrow \pi^0 h_c(1P)$
¹ ABLIKIM 19AG reports $[\Gamma(h_c(1P) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$ $< 0.5 \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$ $= 8.6 \times 10^{-4}$.				

NODE=M144R09
 NODE=M144R09

NODE=M144R09;LINKAGE=A

RADIATIVE DECAYS

$\Gamma(\gamma\eta)/\Gamma_{\text{total}}$ Γ_{10}/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=M144R06
 NODE=M144R06

$\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ Γ_{11}/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_{12}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
51 ± 6 OUR AVERAGE				
$54.3 \pm 6.7 \pm 5.2$	3679	ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$
$48 \pm 6 \pm 7$		¹ DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$48 \pm 6 \pm 7$	1282	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$
$46 \pm 12 \pm 7$	168	³ ROSNER	05 CLEO	$\psi(2S) \rightarrow \pi^0 \eta_c \gamma$

NODE=M144R2
 NODE=M144R2

OCCUR=2

- ¹ Average of DOBBS 08A and ROSNER 05. DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.16 \pm 0.30 \pm 0.37) \times 10^{-4}$ which we divide by
our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P)) = (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their
experiment's error and our second error is the systematic error from using our best value.
- ² DOBBS 08A reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$
 $= (8.6 \pm 1.3) \times 10^{-4}$. Our first error is their experiment's error and our second error is
the systematic error from using our best value.
- ³ ROSNER 05 reports $[\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \pi^0 h_c(1P))]$
 $= (4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \pi^0 h_c(1P))$
 $= (8.6 \pm 1.3) \times 10^{-4}$. 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

NODE=M144R2;LINKAGE=DO

NODE=M144R2;LINKAGE=RO

CROSS-PARTICLE BRANCHING RATIOS

$\Gamma(h_c(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-7}$	90	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$

NODE=M144R05
 NODE=M144R05

$\Gamma(h_c(1P) \rightarrow \gamma \eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \pi^0 h_c(1P))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.3 ± 0.4 OUR AVERAGE				
$4.58 \pm 0.40 \pm 0.50$	3679	¹ ABLIKIM	10B BES3	$\psi(2S) \rightarrow \pi^0 \gamma X$
$4.16 \pm 0.30 \pm 0.37$	1430	² DOBBS	08A CLEO	$\psi(2S) \rightarrow \pi^0 \gamma \eta_c$

NODE=M144R04
 NODE=M144R04

¹ Not independent of other branching fractions in ABLIKIM 10B.

² Not independent of other branching fractions in DOBBS 08A.

NODE=M144R04;LINKAGE=AB
 NODE=M144R04;LINKAGE=DO

$h_c(1P)$ REFERENCES

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

REFID=59858
REFID=58901
REFID=57450
REFID=55583
REFID=54741
REFID=53348
REFID=53103
REFID=52579
REFID=50768
REFID=50812
REFID=49579
REFID=44074
REFID=43307
REFID=43174
REFID=43180

 $\chi_{c2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

NODE=M057

NODE=M057

 $\chi_{c2}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3556.17 $\pm$ 0.07	OUR AVERAGE			
3557.3 $\pm$ 1.7 $\pm$ 0.7	611	¹ AAIJ	17BB LHCb	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3556.10 $\pm$ 0.06 $\pm$ 0.11	4.0k	² AAIJ	17Bi LHCb	$\chi_{c2} \rightarrow J/\psi \mu^+ \mu^-$
3555.3 $\pm$ 0.6 $\pm$ 2.2	2.5k	UEHARA	08 BELL	$\gamma\gamma \rightarrow \text{hadrons}$
3555.70 $\pm$ 0.59 $\pm$ 0.39		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$
3556.173 $\pm$ 0.123 $\pm$ 0.020		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
3559.9 $\pm$ 2.9		EISENSTEIN	01 CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
3556.4 $\pm$ 0.7		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3556.22 $\pm$ 0.131 $\pm$ 0.020	585	³ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
3556.9 $\pm$ 0.4 $\pm$ 0.5	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
3557.8 $\pm$ 0.2 $\pm$ 4		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3553.4 $\pm$ 2.2	66	⁵ LEMOIGNE	82 GOLI	$185 \pi^- \text{Be} \rightarrow \gamma \mu^+ \mu^- A$
3555.9 $\pm$ 0.7		⁶ OREGLIA	82 CBAL	$e^+e^- \rightarrow J/\psi 2\gamma$
3557 $\pm$ 1.5	69	⁷ HIMEL	80 MRK2	$e^+e^- \rightarrow J/\psi 2\gamma$
3551 $\pm$ 11	15	BRANDELIK	79B DASP	$e^+e^- \rightarrow J/\psi 2\gamma$
3553 $\pm$ 4		⁷ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3553 $\pm$ 4 $\pm$ 4		^{7,8} TANENBAUM	78 MRK1	e^+e^-
3563 $\pm$ 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 $\pm$ 1.3	53	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$
3543 $\pm$ 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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
1.97 $\pm$ 0.09	OUR FIT			
2.00 $\pm$ 0.11	OUR AVERAGE			
2.10 $\pm$ 0.20 $\pm$ 0.02	4.0k	AAIJ	17Bi LHCb	$\chi_{c2} \rightarrow J/\psi \mu^+ \mu^-$
1.915 $\pm$ 0.188 $\pm$ 0.013		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
1.96 $\pm$ 0.17 $\pm$ 0.07	585	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
2.6 $\pm$ 1.4 $\pm$ 1.0	50	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
2.8 $\pm$ 2.1 $\pm$ 2.0		² GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

NODE=M057W

NODE=M057W

¹ Recalculated by ANDREOTTI 05A.² Errors correspond to 90% confidence level; authors give only width range.

NODE=M057W;LINKAGE=AN

NODE=M057W;LINKAGE=E

NODE=M057215;NODE=M057

 $\chi_{c2}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Hadronic decays		
Γ_1 $2(\pi^+\pi^-)$	(1.02±0.09) %	
Γ_2 $\rho\rho$		
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	(1.83±0.23) %	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.19±0.34) %	
Γ_5 $4\pi^0$	(1.11±0.15) $\times 10^{-3}$	
Γ_6 $K^+K^-\pi^0\pi^0$	(2.1 ±0.4) $\times 10^{-3}$	
Γ_7 $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(1.38±0.20) %	
Γ_8 $\rho^-K^+\bar{K}^0 + \text{c.c.}$	(4.1 ±1.2) $\times 10^{-3}$	
Γ_9 $K^*(892)^0K^-\pi^+ \rightarrow$ $K^-\pi^+K^0\pi^0 + \text{c.c.}$	(2.9 ±0.8) $\times 10^{-3}$	
Γ_{10} $K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.8 ±0.9) $\times 10^{-3}$	
Γ_{11} $K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.7 ±0.8) $\times 10^{-3}$	
Γ_{12} $K^*(892)^+\bar{K}^0\pi^- \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(2.9 ±0.8) $\times 10^{-3}$	
Γ_{13} $K^+K^-\eta\pi^0$	(1.3 ±0.4) $\times 10^{-3}$	
Γ_{14} $K^+K^-\pi^+\pi^-$	(8.4 ±0.9) $\times 10^{-3}$	
Γ_{15} $K^+K^-\pi^+\pi^-\pi^0$	(1.17±0.13) %	
Γ_{16} $K_S^0K^\pm\pi^\mp\pi^+\pi^-$	(7.3 ±0.8) $\times 10^{-3}$	
Γ_{17} $K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	(2.1 ±1.1) $\times 10^{-3}$	
Γ_{18} $K^*(892)^0K^*(892)^0$	(2.3 ±0.4) $\times 10^{-3}$	
Γ_{19} $3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$	
Γ_{20} $\phi\phi$	(1.06±0.09) $\times 10^{-3}$	
Γ_{21} $\phi\phi\eta$	(5.3 ±0.6) $\times 10^{-4}$	
Γ_{22} $\omega\omega$	(8.4 ±1.0) $\times 10^{-4}$	
Γ_{23} ωK^+K^-	(7.3 ±0.9) $\times 10^{-4}$	
Γ_{24} $\omega\phi$	(9.6 ±2.7) $\times 10^{-6}$	
Γ_{25} $\pi\pi$	(2.23±0.09) $\times 10^{-3}$	
Γ_{26} $\rho^0\pi^+\pi^-$	(3.7 ±1.6) $\times 10^{-3}$	
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} $\pi^+\pi^-\eta$	(4.8 ±1.3) $\times 10^{-4}$	
Γ_{30} $\pi^+\pi^-\eta'$	(5.0 ±1.8) $\times 10^{-4}$	
Γ_{31} $\eta\eta$	(5.4 ±0.4) $\times 10^{-4}$	
Γ_{32} K^+K^-	(1.01±0.06) $\times 10^{-3}$	
Γ_{33} $K_S^0K_S^0$	(5.2 ±0.4) $\times 10^{-4}$	
Γ_{34} $K^*(892)^\pm K^\mp$	(1.44±0.21) $\times 10^{-4}$	
Γ_{35} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	(1.24±0.27) $\times 10^{-4}$	
Γ_{36} $K_2^*(1430)^\pm K^\mp$	(1.48±0.12) $\times 10^{-3}$	
Γ_{37} $K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	(1.24±0.17) $\times 10^{-3}$	
Γ_{38} $K_3^*(1780)^\pm K^\mp$	(5.2 ±0.8) $\times 10^{-4}$	
Γ_{39} $K_3^*(1780)^0\bar{K}^0 + \text{c.c.}$	(5.6 ±2.1) $\times 10^{-4}$	
Γ_{40} $a_2(1320)^0\pi^0$	(1.29±0.34) $\times 10^{-3}$	
Γ_{41} $a_2(1320)^\pm\pi^\mp$	(1.8 ±0.6) $\times 10^{-3}$	
Γ_{42} $\bar{K}^0K^+\pi^- + \text{c.c.}$	(1.28±0.18) $\times 10^{-3}$	
Γ_{43} $K^+K^-\pi^0$	(3.0 ±0.8) $\times 10^{-4}$	
Γ_{44} $K^+K^-\eta$	< 3.2 $\times 10^{-4}$	90%
Γ_{45} $K^+K^-\eta'(958)$	(1.94±0.34) $\times 10^{-4}$	
Γ_{46} $\eta\eta'$	(2.2 ±0.5) $\times 10^{-5}$	
Γ_{47} $\eta'\eta'$	(4.6 ±0.6) $\times 10^{-5}$	

NODE=M057;CLUMP=A

DESIG=3

DESIG=43

DESIG=50

DESIG=51

DESIG=62

DESIG=52

DESIG=54

DESIG=55

DESIG=60

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DESIG=57

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DESIG=91

DESIG=92

DESIG=93

DESIG=94

DESIG=17

DESIG=36

DESIG=40

DESIG=82

DESIG=34

DESIG=35

Г48	$\pi^+\pi^-K_S^0K_S^0$	$(2.2 \pm 0.5) \times 10^{-3}$		DESIG=29
Г49	$K^+K^-K_S^0K_S^0$	$< 4 \times 10^{-4}$	90%	DESIG=30
Г50	$K_S^0K_S^0K_S^0K_S^0$	$(1.13 \pm 0.18) \times 10^{-4}$		DESIG=97
Г51	$K^+K^-K^+K^-$	$(1.65 \pm 0.20) \times 10^{-3}$		DESIG=24
Г52	$K^+K^-\phi$	$(1.42 \pm 0.29) \times 10^{-3}$		DESIG=32
Г53	$\bar{K}^0K^+\pi^-\phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		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	$p\bar{p}$	$(7.33 \pm 0.33) \times 10^{-5}$		DESIG=11
Г57	$p\bar{p}\pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$		DESIG=37
Г58	$p\bar{p}\eta$	$(1.74 \pm 0.25) \times 10^{-4}$		DESIG=41
Г59	$p\bar{p}\omega$	$(3.6 \pm 0.4) \times 10^{-4}$		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	$p\bar{p}\pi^0\pi^0$	$(7.8 \pm 2.3) \times 10^{-4}$		DESIG=53
Г63	$p\bar{p}K^+K^- (\text{non-resonant})$	$(1.91 \pm 0.32) \times 10^{-4}$		DESIG=63
Г64	$p\bar{p}K_S^0K_S^0$	$< 7.9 \times 10^{-4}$	90%	DESIG=28
Г65	$p\bar{n}\pi^-$	$(8.5 \pm 0.9) \times 10^{-4}$		DESIG=31
Г66	$\bar{p}n\pi^+$	$(8.9 \pm 0.8) \times 10^{-4}$		DESIG=75
Г67	$p\bar{n}\pi^-\pi^0$	$(2.17 \pm 0.18) \times 10^{-3}$		DESIG=76
Г68	$\bar{p}n\pi^+\pi^0$	$(2.11 \pm 0.18) \times 10^{-3}$		DESIG=77
Г69	$\Lambda\bar{\Lambda}$	$(1.84 \pm 0.15) \times 10^{-4}$		DESIG=19
Г70	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.25 \pm 0.15) \times 10^{-3}$		DESIG=27
Г71	$\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant})$	$(6.6 \pm 1.5) \times 10^{-4}$		DESIG=70
Г72	$\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	90%	DESIG=71
Г73	$\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	90%	DESIG=72
Г74	$K^+\bar{p}\Lambda + \text{c.c.}$	$(7.8 \pm 0.5) \times 10^{-4}$		DESIG=38
Г75	$K^*(892)^+\bar{p}\Lambda + \text{c.c.}$	$(8.2 \pm 1.1) \times 10^{-4}$		DESIG=101
Г76	$K^+\bar{p}\Lambda(1520) + \text{c.c.}$	$(2.8 \pm 0.7) \times 10^{-4}$		DESIG=64
Г77	$\Lambda(1520)\bar{\Lambda}(1520)$	$(4.6 \pm 1.5) \times 10^{-4}$		DESIG=65
Г78	$\Sigma^0\bar{\Sigma}^0$	$(3.7 \pm 0.6) \times 10^{-5}$		DESIG=47
Г79	$\Sigma^+\bar{p}K_S^0 + \text{c.c.}$	$(8.2 \pm 0.9) \times 10^{-5}$		DESIG=100
Г80	$\Sigma^+\bar{\Sigma}^-$	$(3.4 \pm 0.7) \times 10^{-5}$		DESIG=48
Г81	$\Sigma^-\bar{\Sigma}^+$	$(4.4 \pm 1.8) \times 10^{-5}$		DESIG=102
Г82	$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	90%	DESIG=73
Г83	$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	90%	DESIG=74
Г84	$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(1.76 \pm 0.32) \times 10^{-4}$		DESIG=85
Г85	$\Xi^0\bar{\Xi}^0$	$< 1.0 \times 10^{-4}$	90%	DESIG=49
Г86	$\Xi^-\bar{\Xi}^+$	$(1.42 \pm 0.32) \times 10^{-4}$		DESIG=26
Г87	$J/\psi(1S)\pi^+\pi^-\pi^0$	$< 1.5 \%$	90%	DESIG=12
Г88	$\pi^0\eta_c$	$< 3.2 \times 10^{-3}$	90%	DESIG=81
Г89	$\eta_c(1S)\pi^+\pi^-$	$< 5.4 \times 10^{-3}$	90%	DESIG=69

Radiative decays

Г90	$\gamma J/\psi(1S)$	$(19.0 \pm 0.5) \%$		NODE=M057;CLUMP=B DESIG=6
Г91	$\gamma\rho^0$	$< 1.9 \times 10^{-5}$	90%	DESIG=44
Г92	$\gamma\omega$	$< 6 \times 10^{-6}$	90%	DESIG=45
Г93	$\gamma\phi$	$< 7 \times 10^{-6}$	90%	DESIG=46
Г94	$\gamma\gamma$	$(2.85 \pm 0.10) \times 10^{-4}$		DESIG=7
Г95	$e^+e^-J/\psi(1S)$	$(2.15 \pm 0.14) \times 10^{-3}$		DESIG=86
Г96	$\mu^+\mu^-J/\psi(1S)$	$(2.02 \pm 0.33) \times 10^{-4}$		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 84 branching ratios uses 248 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 378.1$ for 199 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	21								
x_{18}	4	3	1							
x_{20}	7	5	1	3						
x_{25}	7	6	1	4	10					
x_{26}	18	2	0	1	1	1				
x_{31}	3	3	1	2	5	12	1			
x_{32}	5	4	1	3	7	15	1	8		
x_{33}	5	4	1	2	6	13	1	7	8	
x_{42}	2	2	0	1	3	7	0	3	4	4
x_{51}	4	3	1	2	4	7	1	4	5	4
x_{56}	10	9	2	5	9	11	2	5	8	7
x_{69}	3	3	1	2	5	13	1	7	8	7
x_{90}	12	10	2	6	15	34	2	18	22	18
x_{94}	-6	-4	-1	-2	2	20	-2	12	12	10
Γ	-23	-19	-4	-11	-19	-25	-5	-12	-18	-15
	x_1	x_{14}	x_{17}	x_{18}	x_{20}	x_{25}	x_{26}	x_{31}	x_{32}	x_{33}

x_{51}	2					
x_{56}	4	5				
x_{69}	4	4	6			
x_{90}	10	11	4	18		
x_{94}	5	4	18	12	34	
Γ	-8	-11	-45	-12	-46	-43
	x_{42}	x_{51}	x_{56}	x_{69}	x_{90}	x_{94}

$\chi_{c2}(1P)$ PARTIAL WIDTHS

$$\chi_{c2}(1P) \Gamma(i) \Gamma(\gamma J/\psi(1S)) / \Gamma(\text{total})$$

NODE=M057220

NODE=M057223

$$\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{56} \Gamma_{90} / \Gamma$$

NODE=M057G1
NODE=M057G1

VALUE (eV)

DOCUMENT ID

TECN

COMMENT

27.5 ± 1.2 OUR FIT**27.5 ± 1.5 OUR AVERAGE**

27.0 ± 1.5 ± 1.1

27.7 ± 1.5 ± 2.0

36 ± 8

¹ ANDREOTTI 05A E835 $p\bar{p} \rightarrow e^+ e^- \gamma$ ^{1,2} ARMSTRONG 92 E760 $p\bar{p} \rightarrow e^+ e^- \gamma$ ¹ BAGLIN 86B SPEC $p\bar{p} \rightarrow e^+ e^- X$ 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

$$\Gamma(\gamma\gamma) \times \Gamma(\gamma J/\psi(1S)) / \Gamma_{\text{total}}$$

$$\Gamma_{94} \Gamma_{90} / \Gamma$$

NODE=M057G2
NODE=M057G2

VALUE (eV)

EVTS

DOCUMENT ID

TECN

COMMENT

107 ± 5 OUR FIT**117 ± 10 OUR AVERAGE**

111 ± 12 ± 9 147 ± 15

¹ DOBBS 06 CLE3 10.4 $e^+ e^- \rightarrow$ $e^+ e^- \chi_{c2}$

114 ± 11 ± 9 136 ± 13.3

^{1,2} ABE 02T BELL $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

139 ± 55 ± 21

^{1,3} ACCIARRI 99E L3 $e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

242 ± 65 ± 51	1,4 ACKER.,K...	98	OPAL	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
150 ± 42 ± 36	1,5 DOMINICK	94	CLE2	$e^+e^- \rightarrow e^+e^-\chi_{c2}$
470 ± 240 ± 120	1,6 BAUER	93	TPC	$e^+e^- \rightarrow e^+e^-\chi_{c2}$

¹ Calculated by us using $B(J/\psi \rightarrow \ell^+\ell^-) = 0.1187 \pm 0.0008$.

² All systematic errors added in quadrature.

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 $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0597 \pm 0.0025$.

NODE=M057G;LINKAGE=LL

NODE=M057G;LINKAGE=GT

NODE=M057G;LINKAGE=J4

NODE=M057G;LINKAGE=J5

NODE=M057G;LINKAGE=J6

NODE=M057G;LINKAGE=J7

$\chi_{c2}(1P) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M057224

$\Gamma(2(\pi^+\pi^-)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_{94}/\Gamma$

NODE=M057G3

NODE=M057G3

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

5.7 ± 0.5 OUR 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	$e^+e^- \rightarrow e^+e^-\chi_{c2}$

$\Gamma(\rho\rho) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_{94}/\Gamma$

NODE=M057G08

NODE=M057G08

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	$\gamma\gamma \rightarrow \chi_{c2} \rightarrow 2(\pi^+\pi^-)$

$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_{94}/\Gamma$

NODE=M057G09

NODE=M057G09

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

4.7 ± 0.5 OUR FIT

4.42 ± 0.42 ± 0.53 780 ± 74 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{15}\Gamma_{94}/\Gamma$

NODE=M057G02

NODE=M057G02

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

6.5 ± 0.9 ± 1.5 1250 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

$\Gamma(K^*(892)^0\bar{K}^*(892)^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{18}\Gamma_{94}/\Gamma$

NODE=M057G10

NODE=M057G10

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

1.26 ± 0.24 OUR FIT

0.8 ± 0.17 ± 0.27 151 ± 30 UEHARA 08 BELL $\gamma\gamma \rightarrow \chi_{c2} \rightarrow K^+K^-\pi^+\pi^-$

$\Gamma(\phi\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{20}\Gamma_{94}/\Gamma$

NODE=M057G12

NODE=M057G12

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

0.60 ± 0.05 OUR 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 $B(\phi \rightarrow K^+K^-) = (48.9 \pm 0.5)\%$.

NODE=M057G12;LINKAGE=LI

$\Gamma(\omega\omega) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_{94}/\Gamma$

NODE=M057G03

NODE=M057G03

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=M057G03;LINKAGE=LI

$\Gamma(\omega\phi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ $\Gamma_{24}\Gamma_{94}/\Gamma$

NODE=M057G04

NODE=M057G04

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;LINKAGE=LI

$$\frac{\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{25}\Gamma_{94}/\Gamma$$

NODE=M057G4
NODE=M057G4

1.25±0.07 OUR 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;LINKAGE=UE

NODE=M057G;LINKAGE=NA

$$\frac{\Gamma(\rho^0\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{26}\Gamma_{94}/\Gamma$$

NODE=M057G07
NODE=M057G07

2.1±0.9 OUR FIT

3.2±1.9±0.5 986 ± 578 UEHARA 08 BELL γγ → χ_{c2} → 2(π⁺π⁻)

$$\frac{\Gamma(\eta\eta) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{31}\Gamma_{94}/\Gamma$$

NODE=M057G13
NODE=M057G13

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;LINKAGE=UE

$$\frac{\Gamma(K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{32}\Gamma_{94}/\Gamma$$

NODE=M057G5
NODE=M057G5

0.56±0.04 OUR FIT

0.44±0.11±0.07 33 ± 8 NAKAZAWA 05 BELL 10.6 e⁺e⁻ → e⁺e⁻K⁺K⁻

$$\frac{\Gamma(K_S^0 K_S^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{33}\Gamma_{94}/\Gamma$$

NODE=M057G6
NODE=M057G6

0.294±0.025 OUR FIT

0.27 ^{+0.07}_{-0.06} ±0.03 53 ¹ UEHARA 13 BELL γγ → K_S⁰K_S⁰

• • • 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;LINKAGE=UE

$$\frac{\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{42}\Gamma_{94}/\Gamma$$

NODE=M057G01
NODE=M057G01

0.72±0.11 OUR FIT

1.20±0.33±0.13 126 ¹ DEL-AMO-SA..11M BABR γγ → K_S⁰K[±]π[∓]

¹ We have multiplied $\bar{K}K\pi$ by 2/3 to obtain $\bar{K}^0 K^+ \pi^- + \text{c.c.}$

NODE=M057G01;LINKAGE=DE

$$\frac{\Gamma(K^+K^-K^+K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{EVTS} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{51}\Gamma_{94}/\Gamma$$

NODE=M057G11
NODE=M057G11

0.93±0.11 OUR FIT

1.10±0.21±0.15 126 ± 24 UEHARA 08 BELL γγ → χ_{c2} → 2(K⁺K⁻)

$$\frac{\Gamma(\eta_c(1S)\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}}{\text{VALUE (eV)} \quad \text{CL\%} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{89}\Gamma_{94}/\Gamma$$

NODE=M057G05
NODE=M057G05

<15.7 90 LEES 12AE BABR e⁺e⁻ → e⁺e⁻π⁺π⁻η_c

χ_{c2}(1P) BRANCHING RATIOS

NODE=M057225

HADRONIC DECAYS

NODE=M057305

$$\frac{\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}}{\text{VALUE} \quad \text{DOCUMENT ID}} \quad \Gamma_1/\Gamma$$

NODE=M057R2
NODE=M057R2

0.0102±0.0009 OUR FIT

$$\frac{\Gamma(\rho^0\pi^+\pi^-)/\Gamma(2(\pi^+\pi^-))}{\text{VALUE} \quad \text{DOCUMENT ID} \quad \text{TECN} \quad \text{COMMENT}} \quad \Gamma_{26}/\Gamma_1$$

NODE=M057R38
NODE=M057R38

0.36±0.15 OUR FIT

0.31±0.17 TANENBAUM 78 MRK1 ψ(2S) → γχ_{c2}

$$\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.83±0.23±0.04	903.5	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R46
NODE=M057R46

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R46;LINKAGE=HE

$$\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.19±0.34±0.05	1031.9	^{1,2} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R47
NODE=M057R47

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R47;LINKAGE=HE

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;LINKAGE=OC

$$\Gamma(4\pi^0)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.11±0.15±0.02	1164	¹ ABLIKIM	11A BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R58
NODE=M057R58

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R58;LINKAGE=AB

$$\Gamma(K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.206±0.040±0.004	76.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R48
NODE=M057R48

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R48;LINKAGE=HE

$$\Gamma(K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.38±0.19±0.03	211.6	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R50
NODE=M057R50

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R50;LINKAGE=HE

$$\Gamma(\rho^-K^+\bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.41±0.12±0.01	62.9	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R51
NODE=M057R51

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R51;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
0.29±0.08±0.01	38.7	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R57
NODE=M057R57

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R57;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
0.38±0.09±0.01	63.0	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R52
NODE=M057R52

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R52;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
0.37±0.08±0.01	51.1	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R53
NODE=M057R53

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R53;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
0.29±0.08±0.01	39.3	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R54
NODE=M057R54

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R54;LINKAGE=HE

$$\Gamma(K^+ K^- \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.127±0.044±0.003	22.9	¹ HE	08B CLEO	$e^+ e^- \rightarrow \gamma h^+ h^- h^0 h^0$

NODE=M057R55
NODE=M057R55

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R55;LINKAGE=HE

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

VALUE (units 10^{-3})	DOCUMENT ID
8.4±0.9 OUR FIT	

NODE=M057R3
NODE=M057R3

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.69±0.13±1.31	11k	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R00
NODE=M057R00

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

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	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057R73
NODE=M057R73

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2} \gamma) = (8.72 \pm 0.34)\%$.

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

$$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-4})	DOCUMENT ID
21±11 OUR FIT	

NODE=M057R9
NODE=M057R9

$$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-3})	DOCUMENT ID
2.3±0.4 OUR FIT	

NODE=M057R26
NODE=M057R26

$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

8.6±1.8 OUR EVALUATION Treating systematic error as correlated.**8.6±1.8 OUR AVERAGE**

8.6±0.9±1.6

¹ BAI

99B

BES

 $\psi(2S) \rightarrow \gamma\chi_{c2}$

8.7±5.9±0.4

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.

 Γ_{19}/Γ NODE=M057R4
NODE=M057R4

→ UNCHECKED ←

NODE=M057R;LINKAGE=X3

 $\Gamma(\phi\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

1.06±0.09 OUR FIT Γ_{20}/Γ NODE=M057R20
NODE=M057R20 $\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

5.3±0.5±0.4

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$.

 Γ_{21}/Γ NODE=M057R97
NODE=M057R97

NODE=M057R97;LINKAGE=A

 $\Gamma(\omega\omega)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

0.84±0.10 OUR AVERAGE

0.82±0.10±0.02

762

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

1.73±0.57±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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 Γ_{22}/Γ NODE=M057R28
NODE=M057R28

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 $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (8.72 \pm 0.34)\%$.

 Γ_{23}/Γ NODE=M057R74
NODE=M057R74

NODE=M057R74;LINKAGE=A

 $\Gamma(\omega\phi)/\Gamma_{\text{total}}$ VALUE (units 10^{-6})

CL%

EVTS

DOCUMENT ID

TECN

COMMENT

9.6±2.7±0.2

33

¹ ABLIKIM

19J

BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

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

<18

90

^{2,3} ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma$ hadrons

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $< 2 \times 10^{-5}$ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

³ Superseded by ABLIKIM 19J.

 Γ_{24}/Γ NODE=M057R63
NODE=M057R63

NODE=M057R63;LINKAGE=A

NODE=M057R63;LINKAGE=AL

NODE=M057R63;LINKAGE=B

 $\Gamma(\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

DOCUMENT ID

2.23±0.09 OUR FIT Γ_{25}/Γ NODE=M057R27
NODE=M057R27 $\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-4})

DOCUMENT ID

37±16 OUR FIT Γ_{26}/Γ NODE=M057R8
NODE=M057R8

$\Gamma(\pi^+\pi^-\pi^0(\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
2.01±0.42±0.04	64	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$
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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R84
 NODE=M057R84

OCCUR=2

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
0.61±0.38±0.01	15	¹ ABLIKIM	17AG BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$
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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M057R85
 NODE=M057R85

NODE=M057R85;LINKAGE=A

 $\Gamma(\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
0.48±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. • • •				
<1.4	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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				
² ABLIKIM 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.52 \times 10^{-2}$.				

NODE=M057R08
 NODE=M057R08

NODE=M057R08;LINKAGE=AT

NODE=M057R08;LINKAGE=AB

 $\Gamma(\pi^+\pi^-\eta')/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.50±0.18±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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.			

NODE=M057R35
 NODE=M057R35

NODE=M057R35;LINKAGE=AT

 $\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
5.4±0.4 OUR FIT	

NODE=M057R16
 NODE=M057R16

 $\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
1.01±0.06 OUR FIT	

NODE=M057R11
 NODE=M057R11

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
0.52±0.04 OUR FIT	

NODE=M057R19
 NODE=M057R19

 $\Gamma(K_S^0 K_S^0)/\Gamma(\pi\pi)$ Γ_{33}/Γ_{25}

VALUE	DOCUMENT ID	TECN	COMMENT
0.235±0.019 OUR FIT			

NODE=M057R36
 NODE=M057R36

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

0.27 ±0.07 ±0.04 ^{1,2} CHEN 07B BELL $e^+e^- \rightarrow e^+e^-\chi_{c2}$

¹ Using $\Gamma(\pi\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from the $\pi^+\pi^-$ measurement of NAKAZAWA 05 rescaled by 3/2 to convert to $\pi\pi$.

² Not independent from other measurements.

NODE=M057R36;LINKAGE=CH

NODE=M057R36;LINKAGE=NI

$\Gamma(K_S^0 K_S^0)/\Gamma(K^+ K^-)$ Γ_{33}/Γ_{32}

VALUE	DOCUMENT ID	TECN	COMMENT

0.52±0.05 OUR FIT

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

0.70±0.21±0.12	1,2 CHEN	07B BELL	$e^+ e^- \rightarrow e^+ e^- \chi_{c2}$

¹ Using $\Gamma(K^+ K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ from NAKAZAWA 05.² Not independent from other measurements.

NODE=M057R37
 NODE=M057R37

NODE=M057R37;LINKAGE=CH
 NODE=M057R37;LINKAGE=NI

 $\Gamma(K^*(892)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (units 10 ⁻⁴)	DOCUMENT ID	TECN	COMMENT

1.44±0.21±0.03¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

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

² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$ ³ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R86
 NODE=M057R86

OCCUR=2
 OCCUR=3

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

1.24±0.27±0.03¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R87
 NODE=M057R87

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

14.8±1.2±0.3¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

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

² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$ ³ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R88
 NODE=M057R88

OCCUR=2
 OCCUR=3

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

12.4 ± 1.7 ± 0.3¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp$

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R89
NODE=M057R89

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

5.2 ± 0.8 ± 0.1¹ ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K \bar{K} \pi$

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

5.1 ± 1.0 ± 0.1

² ABLIKIM 17AG BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \pi^0$

5.6 ± 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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

5.6 ± 2.1 ± 0.1¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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

12.9 ± 3.4 ± 0.3¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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

17.6 ± 6.1 ± 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

0.30±0.08±0.01¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

NODE=M057R05;LINKAGE=AT

 $\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{44}/Γ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<0.32

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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±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

2.17±0.47±0.05

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 ± 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R03;LINKAGE=A

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R03;LINKAGE=AS

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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±0.6±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 ± 7

² ASNER

09

CLEO

 $\psi(2S) \rightarrow \gamma \eta' \eta'$

<30

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R04;LINKAGE=A

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AS

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R04;LINKAGE=AD

$\Gamma(\pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.17±0.54±0.05	57 ± 11	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R31
NODE=M057R31

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow \pi^+\pi^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (0.207 \pm 0.039 \pm 0.033) \times 10^{-3}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R31;LINKAGE=AB

 $\Gamma(K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<4	90	2.3 ± 2.2	¹ ABLIKIM	050 BES2	$e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M057R32
NODE=M057R32

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] < 3.5 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R32;LINKAGE=AB

 $\Gamma(K_S^0K_S^0K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.13±0.18±0.02	68	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$

NODE=M057R94
NODE=M057R94

¹ Using $B(K_S^0 \rightarrow \pi^+\pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c2}(1P) \rightarrow K_S^0K_S^0K_S^0K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P))] = (10.8 \pm 1.5 \pm 0.8) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

NODE=M057R94;LINKAGE=A

 $\Gamma(K^+K^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{51}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
1.65±0.20 OUR FIT	

NODE=M057R18
NODE=M057R18

 $\Gamma(K^+K^-\phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42±0.29±0.03	52	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$

NODE=M057R01
NODE=M057R01

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R01;LINKAGE=AB

 $\Gamma(\bar{K}^0K^+\pi^-\phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.83±0.32±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±0.16±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±0.06±0.10	408	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c2}$

NODE=M057R75
NODE=M057R75

¹ Using $1.06 \times 10^8 \psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c2}\gamma) = (8.72 \pm 0.34)\%$.

NODE=M057R75;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
0.733±0.033 OUR FIT	

NODE=M057R12
NODE=M057R12

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{57}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.47±0.04 OUR AVERAGE			
0.47±0.04±0.01	¹ ONYISI	10 CLE3	$\psi(2S) \rightarrow \gamma p\bar{p}X$
0.43±0.09±0.01	² ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R06
NODE=M057R06

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R06;LINKAGE=ON

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

0.174±0.025 OUR AVERAGE

0.172±0.026±0.004

¹ ONYISI

10

CLE3

 $\psi(2S) \rightarrow \gamma p\bar{p}X$

0.186±0.070±0.004

² ATHAR

07

CLEO

 $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

0.36±0.04±0.01¹ 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

0.078±0.023±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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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
1.91±0.32±0.04	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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

NODE=M057R59;LINKAGE=AB

 $\Gamma(p\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ 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
8.5±0.9 OUR AVERAGE				
8.4±1.0±0.2	3309	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma p\bar{n}\pi^-$
10.2±3.4±0.2		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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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
8.9±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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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
21.7±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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

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
21.1±1.8±0.4	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 $B(\psi(2S) \rightarrow \gamma\chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

NODE=M057R72;LINKAGE=AL

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.84±0.15 OUR FIT	

NODE=M057R25
 NODE=M057R25

 $\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
125±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	$\psi(2S) \rightarrow \chi_{c2}\gamma$

NODE=M057R29
 NODE=M057R29

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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;LINKAGE=AL

$\Gamma(\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})) / \Gamma_{\text{total}}$

Γ_{71}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$66 \pm 15 \pm 1$	36	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

NODE=M057R65
NODE=M057R65

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R65;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	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Lambda} \pi^-$

NODE=M057R66
NODE=M057R66

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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	$\psi(2S) \rightarrow \gamma \Sigma(1385)^- \bar{\Lambda} \pi^+$

NODE=M057R67
NODE=M057R67

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R67;LINKAGE=AL

$\Gamma(K^+ \bar{p} \Lambda + \text{c.c.}) / \Gamma_{\text{total}}$

Γ_{74}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
7.8 ± 0.5 OUR AVERAGE				
$7.7 \pm 0.5 \pm 0.2$	5k	^{1,2} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
$8.3 \pm 1.6 \pm 0.2$		³ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

NODE=M057R07
NODE=M057R07

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R07;LINKAGE=AB

² Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$.

NODE=M057R07;LINKAGE=LB
NODE=M057R07;LINKAGE=AT

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^*(892)^+ \bar{p} \Lambda + \text{c.c.}) / \Gamma_{\text{total}}$

Γ_{75}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$8.2 \pm 1.1 \pm 0.2$	476	¹ ABLIKIM	19AU BES3	$\psi(2S) \rightarrow \gamma K^{*+} \bar{p} \Lambda$

NODE=M057R98
NODE=M057R98

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^+ \bar{p} \Lambda + \text{c.c.}) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ $= (7.8 \pm 0.9 \pm 0.6) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R98;LINKAGE=F

$\Gamma(K^+ \bar{p} \Lambda(1520) + \text{c.c.}) / \Gamma_{\text{total}}$

Γ_{76}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 0.7 \pm 0.1$	79 ± 13	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M057R60
NODE=M057R60

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R60;LINKAGE=AB

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.6 \pm 1.4 \pm 0.1$	29 ± 7	¹ ABLIKIM	11F BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

NODE=M057R61
NODE=M057R61

¹ ABLIKIM 11F reports $(5.05 \pm 1.29 \pm 0.93) \times 10^{-4}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R61;LINKAGE=AB

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.7 \pm 0.6 \pm 0.1$		91	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

NODE=M057R43
NODE=M057R43

• • • 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R43;LINKAGE=A

² ABLIKIM 13H reports $< 0.65 \times 10^{-4}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R43;LINKAGE=AB

³ NAIK 08 reports $< 0.75 \times 10^{-4}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R43;LINKAGE=NA

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.4 \pm 0.7 \pm 0.1$		55	¹ ABLIKIM	18V BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

NODE=M057R44
NODE=M057R44

• • • 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M057R44;LINKAGE=A

² ABLIKIM 13H reports $< 0.88 \times 10^{-4}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R44;LINKAGE=AB

³ NAIK 08 reports $< 0.67 \times 10^{-4}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R44;LINKAGE=NA

$\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.4 \pm 1.7 \pm 0.5$	131	¹ ABLIKIM	20I BES3	$\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

NODE=M057R99
NODE=M057R99

¹ ABLIKIM 20I reports $(4.4 \pm 1.7 \pm 0.5) \times 10^{-5}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$.

NODE=M057R99;LINKAGE=A

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<16	90	¹ ABLIKIM	12I BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^+ \bar{\Sigma}(1385)^-$

NODE=M057R68
NODE=M057R68

¹ ABLIKIM 12I reports $< 17 \times 10^{-5}$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

NODE=M057R68;LINKAGE=AL

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{83}/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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.				

NODE=M057R69
 NODE=M057R69

NODE=M057R69;LINKAGE=AL

 $\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.76 \pm 0.32 \pm 0.04$	51	¹ ABLIKIM 15I	BES3	$\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$
¹ ABLIKIM 15I reports $[\Gamma(\chi_{c2}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ $= (1.68 \pm 0.26 \pm 0.15) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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

NODE=M057R81;LINKAGE=A

 $\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<1.0	90	2.9 ± 1.7	¹ NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^0 \Xi^0$
¹ NAIK 08 reports $< 1.06 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^0 \Xi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.					

NODE=M057R45
 NODE=M057R45

NODE=M057R45;LINKAGE=NA

 $\Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.42 \pm 0.31 \pm 0.03$	29 ± 5		¹ NAIK 08	CLEO	$\psi(2S) \rightarrow \gamma \Xi^- \Xi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 3.7	90		² ABLIKIM 06D	BES2	$\psi(2S) \rightarrow \chi_{c2} \gamma$
¹ NAIK 08 reports $(1.45 \pm 0.30 \pm 0.15) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c2}(1P) \rightarrow \Xi^- \Xi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))]$ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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=M057R17
 NODE=M057R17

NODE=M057R17;LINKAGE=NA

NODE=M057R17;LINKAGE=AB

 $\Gamma(J/\psi(1S) \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.015	90	BARATE 81	SPEC	$190 \text{ GeV } \pi^- \text{ Be} \rightarrow 2\pi 2\mu$

NODE=M057R13
 NODE=M057R13

 $\Gamma(\pi^0 \eta_c)/\Gamma_{\text{total}}$ Γ_{88}/Γ

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 $B(\eta_c \rightarrow K_S^0 K^\pm \pi^\mp) \times B(K_S^0 \rightarrow \pi^+ \pi^-) \times B(\pi^0 \rightarrow \gamma \gamma) = (1.66 \pm 0.11) \times 10^{-2}$.				

NODE=M057R77
 NODE=M057R77

NODE=M057R77;LINKAGE=A

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{89}/Γ

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.				

NODE=M057R76
 NODE=M057R76

OCCUR=2

NODE=M057R76;LINKAGE=A

NODE=M057R76;LINKAGE=B

NODE=M057R76;LINKAGE=C

 $\Gamma(\eta_c(1S) \pi^+ \pi^-)/\Gamma(K^0 K^+ \pi^- + \text{c.c.})$ Γ_{89}/Γ_{42}

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.				

NODE=M057R64
 NODE=M057R64

NODE=M057R64;LINKAGE=LE

RADIATIVE DECAYS

 $\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$
 Γ_{90}/Γ

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

19.0 ± 0.5 OUR FIT

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

18.64 ± 0.08 ± 1.69	1.0M	¹ ABLIKIM	17U BES3	$e^+e^- \rightarrow \gamma X$
19.9 ± 0.5 ± 1.2		² ADAM	05A CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c2}$

¹ Not independent from $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))$ and the product $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) \times B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))$ also measured in ABLIKIM 17U.

² Uses $B(\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow \gamma \gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma \chi_{c2})$ from ATHAR 04.

NODE=M057310

 NODE=M057R7
 NODE=M057R7

NODE=M057R7;LINKAGE=A

NODE=M057R7;LINKAGE=AD

 $\Gamma(\gamma \rho^0)/\Gamma_{\text{total}}$
 Γ_{91}/Γ

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

 NODE=M057R40
 NODE=M057R40

NODE=M057R40;LINKAGE=AB

NODE=M057R40;LINKAGE=BE

 $\Gamma(\gamma \omega)/\Gamma_{\text{total}}$
 Γ_{92}/Γ

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

 NODE=M057R41
 NODE=M057R41

NODE=M057R41;LINKAGE=AB

NODE=M057R41;LINKAGE=BE

 $\Gamma(\gamma \phi)/\Gamma_{\text{total}}$
 Γ_{93}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

< 7 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = 9.52 \times 10^{-2}$.

 NODE=M057R42
 NODE=M057R42

NODE=M057R42;LINKAGE=AB

NODE=M057R42;LINKAGE=BE

 $\Gamma(\gamma \gamma)/\Gamma_{\text{total}}$
 Γ_{94}/Γ

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

2.85 ± 0.10 OUR FIT

 NODE=M057R1
 NODE=M057R1

 $\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$
 Γ_{95}/Γ

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

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

2.37 ± 0.15 ± 0.05 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) = (9.52 \pm 0.20) \times 10^{-2}$. 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_{95}/Γ_{90}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.3±0.4±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_{96}/Γ_{95}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.40±0.79±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_{94}/Γ_{90}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
1.50±0.05 OUR 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

NODE=M057R;LINKAGE=7A

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}} \times \Gamma(p\bar{p})/\Gamma_{\text{total}}$ $\Gamma_{94}/\Gamma \times \Gamma_{56}/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
2.09±0.13 OUR 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

 $\chi_{c2}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M057230

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{14}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
2.31±0.26 OUR FIT			
2.5 ±0.9 OUR AVERAGE			Error includes scale factor of 2.3.
1.90±0.14±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

NODE=M057B18;LINKAGE=TA

$$\Gamma(\chi_{c2}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
2.1 ±0.4 OUR FIT			
3.11±0.36±0.48	ABLIKIM 04H	BES2	$\psi(2S) \rightarrow \gamma \chi_{c2}$

NODE=M057B19
NODE=M057B19

$$\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)$$

$$\Gamma_{56}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
2.01±0.09 OUR FIT			
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=M057B1
NODE=M057B1

NODE=M057B;LINKAGE=J8

$$\Gamma(\chi_{c2}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_{56}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
6.98±0.32 OUR FIT				
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
NODE=M057B6

NODE=M057B6;LINKAGE=NA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{69} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
17.5±1.3 OUR FIT				
17.4±1.4 OUR AVERAGE				

18.2±1.4±0.9	207	¹ ABLIKIM	13H	BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$
15.9±2.1±1.0	71 ± 9	² NAIK	08	CLEO	$\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda}$

¹ 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 $B(\psi(2S) \rightarrow \gamma \chi_{c2}) = (8.74 \pm 0.35)\%$.

² 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
NODE=M057B10

NODE=M057B10;LINKAGE=AB

NODE=M057B10;LINKAGE=NA

$$\Gamma(\chi_{c2}(1P) \rightarrow \Lambda \bar{\Lambda}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{69} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
5.1±0.4 OUR FIT				

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 $[B(\chi_{c2} \rightarrow \Lambda \bar{\Lambda}) B(\psi(2S) \rightarrow \gamma \chi_{c2}) / B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-)] \times [B^2(\Lambda \rightarrow \pi^- p) / B(J/\psi \rightarrow p \bar{p})] = (1.33^{+0.59}_{-0.55} \pm 0.25)\%$. 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=M057B11
NODE=M057B11

NODE=M057B11;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \pi \pi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{25} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.12±0.08 OUR FIT				
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	$\psi(2S) \rightarrow \gamma \pi^0 \pi^0$

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
NODE=M057B02

OCCUR=2

NODE=M057B02;LINKAGE=AB

NODE=M057B02;LINKAGE=AS

NODE=M057B02;LINKAGE=AN

$$\Gamma(\chi_{c2}(1P) \rightarrow \pi \pi) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\Gamma_{25} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.612±0.023 OUR 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

NODE=M057B;LINKAGE=BM

NODE=M057B;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \eta \eta) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}}$$

$$\Gamma_{31} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{\psi(2S)}$$

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	$\psi(2S) \rightarrow \gamma \eta \eta$

NODE=M057B04
NODE=M057B04

• • • 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;LINKAGE=AB

NODE=M057B04;LINKAGE=AD

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{32} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10 ⁻⁵)	EVTS	DOCUMENT ID	TECN	COMMENT
9.6 ± 0.6 OUR 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

NODE=M057B03;LINKAGE=AS

$$\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times \Gamma_{32} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
0.276 ± 0.017 OUR 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

NODE=M057B;LINKAGE=BI

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{33} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

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

$$\Gamma(\chi_{c2}(1P) \rightarrow K_S^0 K_S^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) \times \Gamma_{33} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma_{11}^{\psi(2S)}$$

VALUE (units 10 ⁻⁵)	DOCUMENT ID	TECN	COMMENT
14.4 ± 1.1 OUR 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

NODE=M057B13;LINKAGE=BA

$$\Gamma(\chi_{c2}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P)) / \Gamma_{\text{total}} \times \Gamma_{42} / \Gamma \times \Gamma_{155}^{\psi(2S)} / \Gamma^{\psi(2S)}$$

VALUE (units 10 ⁻⁴)	EVTS	DOCUMENT ID	TECN	COMMENT
1.22 ± 0.17 OUR 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

NODE=M057B05;LINKAGE=AT

NODE=M057B05;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow 2(\pi^+ \pi^-))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{51}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

2.79±0.26 OUR FIT**3.1 ±1.0 OUR AVERAGE** Error includes scale factor of 2.5.

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

NODE=M057B;LINKAGE=K1

NODE=M057B;LINKAGE=K2

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{51}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.57±0.19 OUR 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

NODE=M057B14;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow K^+ K^- K^+ K^-)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{51}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

4.5±0.5 OUR FIT**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
NODE=M057B15

NODE=M057B15;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{20}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

1.01±0.08 OUR FIT**0.98±0.13 OUR AVERAGE** Error includes scale factor of 1.3.

0.94±0.03±0.10

849

¹ ABLIKIM

11K

BES3

 $\psi(2S) \rightarrow \gamma \text{ hadrons}$

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
NODE=M057B16

NODE=M057B16;LINKAGE=AL

NODE=M057B16;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \phi \phi)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{20}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

2.92±0.24 OUR FIT**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
NODE=M057B17

NODE=M057B17;LINKAGE=BA

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.})}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{79}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{155}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-6})

EVTS

DOCUMENT ID

TECN

COMMENT

7.85±0.77±0.44

129

¹ ABLIKIM

19BB

BES3

 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

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
NODE=M057B07

NODE=M057B07;LINKAGE=A

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{90}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma\psi(2S)}$$

<u>VALUE (units 10^{-2})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.81 $\pm$ 0.04	OUR FIT			
1.69 $\pm$ 0.16	OUR AVERAGE	Error includes scale factor of 3.4.		See the ideogram below.
1.996 $\pm$ 0.008 $\pm$ 0.070	81k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma J/\psi$
1.793 $\pm$ 0.008 $\pm$ 0.163	1.0M	ABLIKIM	17U BES3	$e^+e^- \rightarrow \gamma X$
1.62 $\pm$ 0.04 $\pm$ 0.12	5.8k	BAI	04I BES2	$\psi(2S) \rightarrow J/\psi \gamma\gamma$
0.99 $\pm$ 0.10 $\pm$ 0.08		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
1.47 $\pm$ 0.17		² OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma X_{c2}$
1.8 $\pm$ 0.5		³ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma X_{c2}$
1.2 $\pm$ 0.2		³ BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma X_{c2}$
2.2 $\pm$ 1.2		⁴ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$
1.2 $\pm$ 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

¹Uses $B(J/\psi \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.

²Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020$.

³Recalculated 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
NODE=M057B2

NODE=M057B2:LINKAGE=A

NODE=M057B:LINKAGE=3Q

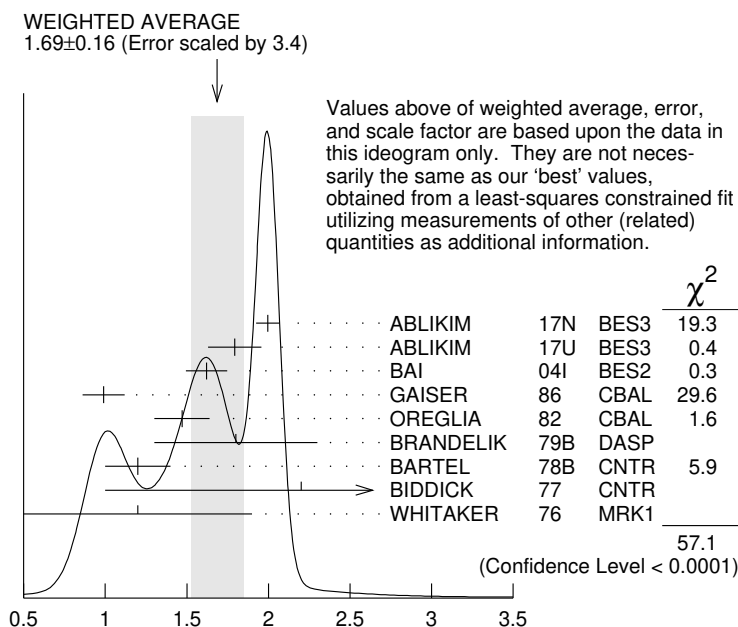
NODE=M057B:LINKAGE=2Q

NODE=M057B;LINKAGE=EA

NODE=M057B2:LINKAGE=B

NODE=M057B2:LINKAGE=ME

NODE=M057B:LINKAGE=AD



$$\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))/\Gamma_{\text{total}} \text{ (units } 10^{-2})$$

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})} = \frac{\Gamma_{90}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{90}/\Gamma \times \Gamma_{155}^{\psi(2S)}/\Gamma_9^{\psi(2S)} + \Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)} + \Gamma_{13}^{\psi(2S)} + 0.343\Gamma_{154}^{\psi(2S)} + 0.190\Gamma_{155}^{\psi(2S)})}$$

<u>VALUE (units 10^{-2})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2.95±0.06 OUR FIT				

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

$3.12 \pm 0.03 \pm 0.09$	12.4k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2}$
$3.11 \pm 0.07 \pm 0.07$	1.9k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹Not independent from other measurements of MENDEZ 08.

NODE=M057B7

NODE=M057B7

NODE=M057B7

NODE=M057B7:LINKAGE=ME

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \times \frac{\Gamma_{90}}{\Gamma} \times \frac{\Gamma_{155}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

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

5.22±0.11 OUR FIT**5.53±0.17 OUR AVERAGE**

5.56±0.05±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±0.13±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=M057B3
NODE=M057B3

NODE=M057B;LINKAGE=AB

NODE=M057B;LINKAGE=H8

NODE=M057B3;LINKAGE=AD

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma)}{\Gamma_{\text{total}}} \times \frac{\Gamma(\psi(2S) \rightarrow \gamma \chi_{c2}(1P))}{\Gamma_{\text{total}}} \times \frac{\Gamma_{94}}{\Gamma} \times \frac{\Gamma_{155}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

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

2.71±0.08 OUR FIT**2.82±0.10 OUR AVERAGE**

2.83±0.08±0.06	5k	¹ ABLIKIM	17AE	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
2.68±0.28±0.15	0.3k	ECKLUND	08A	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$
7.0 ±2.1 ±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±0.17±0.15	1.1k	² ABLIKIM	12A	BES3	$\psi(2S) \rightarrow \gamma \chi_{c2} \rightarrow 3\gamma$

¹ ABLIKIM 17AE measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \frac{\Gamma_{\gamma\gamma}^{\lambda=0}}{\Gamma_{\gamma\gamma}^{\lambda=2}} = 0.000 \pm 0.006 \pm 0.012$.

² ABLIKIM 12A measures the ratio of two-photon partial widths for the helicity $\lambda = 0$ and helicity $\lambda = 2$ components to be $f_{0/2} = \frac{\Gamma_{\gamma\gamma}^{\lambda=0}}{\Gamma_{\gamma\gamma}^{\lambda=2}} = 0.00 \pm 0.02 \pm 0.02$. Superseded by ABLIKIM 17AE.

NODE=M057B4
NODE=M057B4

NODE=M057B4;LINKAGE=A

NODE=M057B4;LINKAGE=AB

$$\frac{\Gamma(\chi_{c2}(1P) \rightarrow \gamma\gamma)}{\Gamma(\chi_{c0}(1P) \rightarrow \gamma\gamma)} \times \frac{\Gamma_{94}}{\Gamma_{94}^{\chi_{c0}(1P)}}$$

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=M057B06

NODE=M057B06;LINKAGE=AB

NODE=M057B06;LINKAGE=A

MULTIPOLE AMPLITUDES IN $\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)$ RADIATIVE DECAY

NODE=M057240

$a_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ 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 ⁺ _{−4.1} ±0.6	5.9k	³ AMBROGIANI	02	E835	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
−14 ± 6	1.9k	³ ARMSTRONG	93E	E760	$p\bar{p} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
−33.3 ⁺ _{−29.2} ±11.6	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 M_2 amplitudes a_2 and b_2 , and fixed E_3 amplitudes $a_3=b_3=0$.

³ Assuming $a_3=0$.

⁴ From a fit with floating M_2 and E_3 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

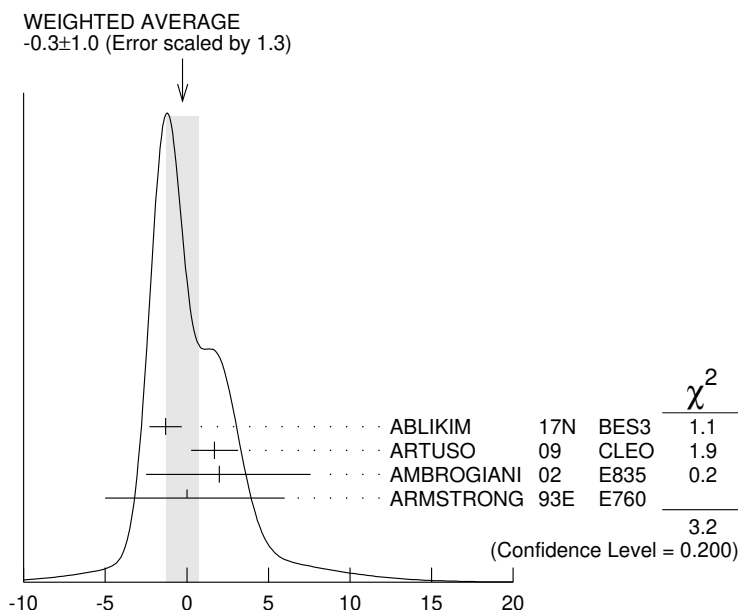
$a_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude

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.		
$-1.3 \pm 0.9 \pm 0.4$	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$1.7 \pm 1.4 \pm 0.3$	19.8k	² ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$2.0^{+5.5}_{-4.4} \pm 0.9$	5908	AMBROGIANI	02 E835	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
0^{+6}_{-5}	1904	ARMSTRONG	93E E760	$\rho\bar{\rho} \rightarrow \chi_{c2} \rightarrow J/\psi\gamma$
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



$a_3 = E3/\sqrt{E1^2 + M2^2 + E3^2}$ Electric octupole fractional transition amplitude (units 10^{-2})

MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma\chi_{c2}(1P)$ RADIATIVE DECAY

$b_2 = M2/\sqrt{E1^2 + M2^2 + E3^2}$ Magnetic quadrupole fractional transition amplitude

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.		
$1.7 \pm 0.8 \pm 0.2$	89k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
$4.6 \pm 1.0 \pm 1.3$	13.8k	² ABLIKIM	11I BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-, \gamma K^+K^-$
$0.2 \pm 1.5 \pm 0.4$	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	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.0 \pm 1.3 \pm 0.3$	19.8k	⁴ ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
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 $\rho_{b_2 b_3} = 0.384$.				
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 $a_3=b_3=0$.				

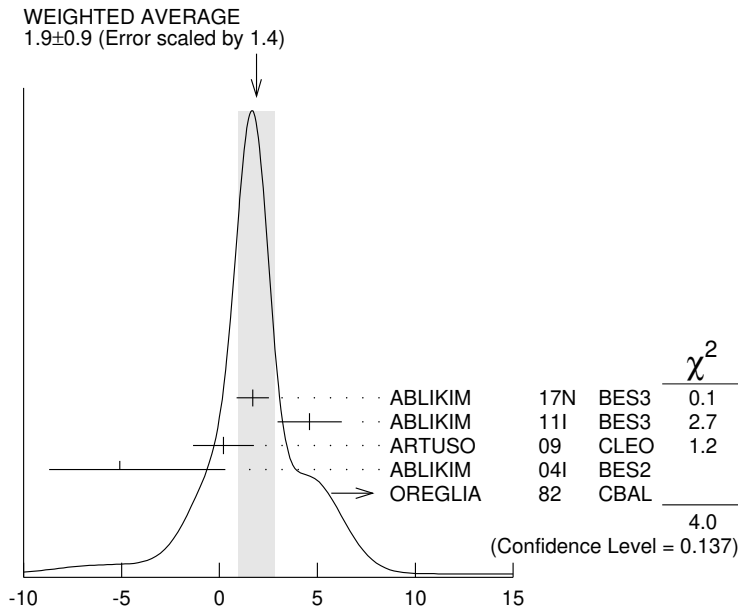
NODE=M057250

NODE=M057QB2
NODE=M057QB2

OCCUR=2

NODE=M057QB2;LINKAGE=A

NODE=M057QB2;LINKAGE=AB
NODE=M057QB2;LINKAGE=AT
NODE=M057QB2;LINKAGE=AR



$b_2 = M_2/\sqrt{E_1^2 + M_2^2 + E_3^2}$ 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 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
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
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

NODE=M057

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
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
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. Akerstaff <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

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

Quantum numbers are quark model predictions.

NODE=M059

NODE=M059

NODE=M059M

NODE=M059M

$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3637.5$\pm$1.1 OUR AVERAGE Error includes scale factor of 1.2.				
3635.1 $\pm$ 3.7 $\pm$ 2.9	106	XU	18 BELL	$e^+e^- \rightarrow e^+e^-\eta'\pi^+\pi^-$
3633.6 $\pm$ 1.7 $\pm$ 0.6	106	¹ AAIJ	17ADLHCB	$pp \rightarrow B^+X \rightarrow p\bar{p}K^+X$
3636.4 $\pm$ 4.1 $\pm$ 0.7	365	² AAIJ	17BBLHCB	$pp \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3637.0 $\pm$ 5.7 $\pm$ 3.4	178	^{3,4} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\pi^0$
3635.1 $\pm$ 5.8 $\pm$ 2.1	47	^{3,5} LEES	14E BABR	$\gamma\gamma \rightarrow K^+K^-\eta$
3646.9 $\pm$ 1.6 $\pm$ 3.6	57 $\pm$ 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
3637.6 $\pm$ 2.9 $\pm$ 1.6	127 $\pm$ 18	⁶ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K\pi, KK\pi^0$
3638.5 $\pm$ 1.5 $\pm$ 0.8	624	³ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
3640.5 $\pm$ 3.2 $\pm$ 2.5	1201	³ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$
3636.1 $^{+3.9+0.7}_{-4.2-2.0}$	128	⁷ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$
3626 $\pm 5 \pm 6$	311	⁸ ABE	07 BELL	$e^+e^- \rightarrow J/\psi(c\bar{c})$
3645.0 $\pm$ 5.5 $^{+4.9}_{-7.8}$	121 $\pm$ 27	AUBERT	05C BABR	$e^+e^- \rightarrow J/\psi c\bar{c}$
3642.9 $\pm$ 3.1 $\pm$ 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 $\pm$ 52	⁹ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
3630.8 $\pm$ 3.4 $\pm$ 1.0	112 $\pm$ 24	¹⁰ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
3654 $\pm 6 \pm 8$	39 $\pm$ 11	¹¹ CHOI	02 BELL	$B \rightarrow K K_S K^-\pi^+$
3594 ± 5		¹² EDWARDS	82C CBAL	$e^+e^- \rightarrow \gamma X$

OCCUR=2

OCCUR=2

¹AAIJ 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.

²From a fit of the $\phi\phi$ invariant mass with the width of $\eta_c(2S)$ fixed to the PDG 16 value.

³Ignoring possible interference with continuum.

⁴With a width fixed to 11.3 MeV.

⁵With a width fixed to 11.3 MeV. Using both $\eta \rightarrow \gamma\gamma$ and $\eta \rightarrow \pi^+\pi^-\pi^0$ decays.

⁶From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+K^-\pi^0$ decay modes.

⁷Accounts for interference with non-resonant continuum.

⁸From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

⁹From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁰Superseded by DEL-AMO-SANCHEZ 11M.

¹¹Superseded by VINOKUROVA 11.

¹²Assuming mass of $\psi(2S) = 3686$ MeV.

NODE=M059M;LINKAGE=B

NODE=M059M;LINKAGE=C
 NODE=M059M;LINKAGE=DE
 NODE=M059M;LINKAGE=LE
 NODE=M059M;LINKAGE=LS
 NODE=M059M;LINKAGE=AB
 NODE=M059M;LINKAGE=VA
 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
11.3$^{+3.2}_{-2.9}$ OUR AVERAGE					
9.9 $\pm$ 4.8 $\pm$ 2.9		57 $\pm$ 17	ABLIKIM	13K BES3	$\psi(2S) \rightarrow \gamma K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$
16.9 $\pm$ 6.4 $\pm$ 4.8		127 $\pm$ 18	¹³ ABLIKIM	12G BES3	$\psi(2S) \rightarrow \gamma K^0 K\pi, KK\pi^0$
13.4 $\pm$ 4.6 $\pm$ 3.2		624	¹⁴ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$
6.6 $^{+8.4+2.6}_{-5.1-0.9}$		128	¹⁵ VINOKUROVA	11 BELL	$B^\pm \rightarrow K^\pm(K_S^0 K^\pm \pi^\mp)$
6.3 $\pm$ 12.4 $\pm$ 4.0		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. • • •					
< 23	90	98 $\pm$ 52	¹⁶ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_{c\bar{c}}$
22 $\pm$ 14		121 $\pm$ 27	AUBERT	05C BABR	$e^+e^- \rightarrow J/\psi c\bar{c}$
17.0 $\pm$ 8.3 $\pm$ 2.5		112 $\pm$ 24	¹⁷ AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
<55	90	39 $\pm$ 11	¹⁸ CHOI	02 BELL	$B \rightarrow K K_S K^-\pi^+$
<8.0	95		¹⁹ EDWARDS	82C CBAL	$e^+e^- \rightarrow \gamma X$

NODE=M059W

NODE=M059W

¹³ From a simultaneous fit to $K_S^0 K^\pm \pi^\mp$ and $K^+ K^- \pi^0$ decay modes.

¹⁴ Ignoring possible interference with continuum.

¹⁵ Accounts for interference with non-resonant continuum.

¹⁶ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

¹⁷ Superseded by DEL-AMO-SANCHEZ 11M.

¹⁸ For a mass value of 3654 ± 6 MeV. Superseded by VINOKUROVA 11.

¹⁹ 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	not seen	
Γ_2 $K \bar{K} \pi$	(1.9 ± 1.2) %	
Γ_3 $K \bar{K} \eta$	(5 ± 4) $\times 10^{-3}$	
Γ_4 $2\pi^+ 2\pi^-$	not seen	
Γ_5 $\rho^0 \rho^0$	not seen	
Γ_6 $3\pi^+ 3\pi^-$	not seen	
Γ_7 $K^+ K^- \pi^+ \pi^-$	not seen	
Γ_8 $K^{*0} \bar{K}^{*0}$	not seen	
Γ_9 $K^+ K^- \pi^+ \pi^- \pi^0$	(1.4 ± 1.0) %	
Γ_{10} $K^+ K^- 2\pi^+ 2\pi^-$	not seen	
Γ_{11} $K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	seen	
Γ_{12} $2K^+ 2K^-$	not seen	
Γ_{13} $\phi \phi$	not seen	
Γ_{14} $p \bar{p}$	seen	
Γ_{15} $p \bar{p} \pi^+ \pi^-$	seen	
Γ_{16} $\gamma \gamma$	(1.9 ± 1.3) $\times 10^{-4}$	
Γ_{17} $\gamma J/\psi(1S)$	< 1.4 %	90%
Γ_{18} $\pi^+ \pi^- \eta$	not seen	
Γ_{19} $\pi^+ \pi^- \eta'$	not seen	
Γ_{20} $\pi^+ \pi^- \eta_c(1S)$	< 25 %	90%

DESIG=1
 DESIG=4
 DESIG=20
 DESIG=5
 DESIG=16
 DESIG=8;OUR EVAL;→ UNCHECKED ←
 DESIG=6
 DESIG=17
 DESIG=9
 DESIG=10;OUR EVAL;→ UNCHECKED ←
 DESIG=11
 DESIG=7
 DESIG=18
 DESIG=3
 DESIG=22
 DESIG=2
 DESIG=21
 DESIG=12;OUR EVAL;→ UNCHECKED ←
 DESIG=13;OUR EVAL;→ UNCHECKED ←
 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	²⁰ XU	18	BELL	$e^+ e^- \rightarrow e^+ e^- \eta' \pi^+ \pi^-$
1.3 ± 0.6		²¹ ASNER	04	CLEO	$\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$

²⁰ Assuming that the branching fraction into $\eta' \pi^+ \pi^-$ is the same as for $\eta_c(1S)$.

²¹ 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

$\Gamma(2\pi^+ 2\pi^-) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_4 \Gamma_{16} / \Gamma$

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

$\Gamma(K \bar{K} \pi) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_{16} / \Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

$41 \pm 4 \pm 6$	624	²² DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$

NODE=M059G04
 NODE=M059G04

²² Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G04;LINKAGE=DE

$$\Gamma(K^+K^-\pi^+\pi^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_7\Gamma_{16}/\Gamma$$

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

$$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_9\Gamma_{16}/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
30±6±5	1201	²³ DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$

NODE=M059G05
NODE=M059G05

²³ Not independent from other measurements reported in DEL-AMO-SANCHEZ 11M.

NODE=M059G05;LINKAGE=DE

$$\Gamma(2K^+2K^-) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{12}\Gamma_{16}/\Gamma$$

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

$$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_{16}/\Gamma$$

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

$$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}} \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}} \quad \Gamma_{14}/\Gamma \times \Gamma_{16}/\Gamma$$

VALUE (units 10 ⁻⁸)	CL%	DOCUMENT ID	TECN	COMMENT
< 5.6	90 ^{24,25,26}	AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$

NODE=M059G1
NODE=M059G1

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

< 8.0	90 ^{24,25,27}	AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$
<12.0	90	^{25,27} AMBROGIANI	01	E835 $\bar{p}p \rightarrow \gamma\gamma$

OCCUR=2
OCCUR=3

²⁴ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.

²⁵ For a total width $\Gamma=5$ MeV.

²⁶ For the resonance mass region 3589–3599 MeV/ c^2 .

²⁷ For the resonance mass region 3575–3660 MeV/ c^2 .

NODE=M059G1;LINKAGE=A
NODE=M059G1;LINKAGE=B
NODE=M059G1;LINKAGE=C1
NODE=M059G1;LINKAGE=C2

$\eta_c(2S)$ BRANCHING RATIOS

NODE=M059220

$$\Gamma(\text{hadrons})/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABREU	98O	DLPH $e^+e^- \rightarrow e^+e^- + \text{hadrons}$

NODE=M059R1
NODE=M059R1

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

seen	²⁸ EDWARDS	82C	CBAL $e^+e^- \rightarrow \gamma X$

²⁸ For a mass value of 3594 ± 5 MeV

NODE=M059R;LINKAGE=W

$$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
1.9±0.4±1.1	59 ± 12	²⁹ AUBERT	08AB	BABR $B \rightarrow \eta_c(2S)K \rightarrow K\bar{K}\pi K$

NODE=M059R3
NODE=M059R3

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

seen	127 ± 18	ABLIKIM	13K	BES3 $\psi(2S) \rightarrow \gamma K\bar{K}\pi$
seen	39 ± 11	³⁰ CHOI	02	BELL $B \rightarrow K K_S K^-\pi^+$

²⁹ Derived from a measurement of $[B(B^+ \rightarrow \eta_c(2S)K^+) \times B(\eta_c(2S) \rightarrow K\bar{K}\pi)] / [B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (9.6^{+2.0}_{-1.9} \pm 2.5)\%$ and using $B(B^+ \rightarrow \eta_c(2S)K^+) = (3.4 \pm 1.8) \times 10^{-4}$, and $[B(B^+ \rightarrow \eta_c K^+) \times B(\eta_c \rightarrow K\bar{K}\pi)] = (6.88 \pm 0.77^{+0.55}_{-0.66}) \times 10^{-5}$.

NODE=M059R3;LINKAGE=AU

³⁰ For a mass value of 3654 ± 6 MeV

NODE=M059R;LINKAGE=W2

$$\Gamma(K\bar{K}\eta)/\Gamma(K\bar{K}\pi) \quad \Gamma_3/\Gamma_2$$

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
27.3±7.0±9.0	225	³¹ LEES	14E	BABR $\gamma\gamma \rightarrow K^+K^-\gamma\gamma$

NODE=M059R26
NODE=M059R26

³¹ 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;LINKAGE=LE

$$\Gamma(2\pi^+2\pi^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
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
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
not seen	UEHARA	08 BELL	$\gamma\gamma \rightarrow \eta_c(2S)$

NODE=M059R02
NODE=M059R02

 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma(K \bar{K} \pi)$ Γ_9/Γ_2

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.73 \pm 0.17 \pm 0.17$	1201	³² DEL-AMO-SA..11M	BABR	$\gamma\gamma \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059R21
NODE=M059R21

³²We 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;LINKAGE=DE

 $\Gamma(K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	11H BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R16
NODE=M059R16

 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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
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
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
seen	106	³³ AAIJ	17AD LHCb	$p\bar{p} \rightarrow B^+ X \rightarrow p\bar{p} K^+ X$

NODE=M059R04
NODE=M059R04
OCCUR=2

³³AAIJ 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;LINKAGE=A

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	110	³⁴ CHILIKIN	19 BELL	$e^+ e^- \rightarrow \Upsilon(4S)$

NODE=M059R30
NODE=M059R30

³⁴CHILIKIN 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;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. • • •				

NODE=M059R2
NODE=M059R2

$<4 \times 10^{-4}$	90	³⁵ 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	$\psi' \rightarrow \text{photons}$

³⁵WICHT 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;LINKAGE=WI

 $\Gamma(\pi^+ \pi^- \eta_c(1S))/\Gamma(K \bar{K} \pi)$ Γ_{20}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.33	90	³⁶ LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

NODE=M059R23
NODE=M059R23

³⁶We divided the reported limit by 3 to take into account isospin relations.

NODE=M059R23;LINKAGE=LE

$\eta_c(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M059230

 $\Gamma(\eta_c(2S) \rightarrow K \bar{K} \eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S))/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				

NODE=M059R25
NODE=M059R25

$<11.8 \times 10^{-6}$	90	³⁷ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \eta$

³⁷ 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;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_4 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 14.6 \times 10^{-6}$	90	³⁸ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 2\pi^+ 2\pi^-$

NODE=M059R05
NODE=M059R05

³⁸ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R05;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \rho^0 \rho^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_5 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

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

$$\Gamma(\eta_c(2S) \rightarrow 3\pi^+ 3\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_6 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 13.2 \times 10^{-6}$	90	³⁹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

NODE=M059R06
NODE=M059R06

³⁹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R06;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_7 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9.6 \times 10^{-6}$	90	⁴⁰ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

NODE=M059R07
NODE=M059R07

⁴⁰ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R07;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^{*0} \bar{K}^{*0}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_8 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

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

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_9 / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 43.0 \times 10^{-6}$	90	⁴¹ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M059R08
NODE=M059R08

⁴¹ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R08;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K^+ K^- 2\pi^+ 2\pi^-) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_{10} / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9.7 \times 10^{-6}$	90	⁴² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K^+ K^- 2\pi^+ 2\pi^-$

NODE=M059R09
NODE=M059R09

⁴² Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R09;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \eta_c(2S)) / \Gamma_{\text{total}} \times \Gamma_{11} / \Gamma \times \Gamma_{157}^{\psi(2S)} / \Gamma \psi(2S)$$

VALUE (units 10^{-6})	CL%	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	⁴³ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$

⁴³ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R10;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \phi\phi)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{13}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

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

$$\Gamma(\eta_c(2S) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{14}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

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

$$\Gamma(\eta_c(2S) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{17}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$<9.7 \times 10^{-6}$	90	33	44 ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma J/\psi$

NODE=M059R27
NODE=M059R27

⁴⁴ 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

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{18}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4.3 \times 10^{-6}$	90	⁴⁵ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\eta$

NODE=M059R11
NODE=M059R11

⁴⁵ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R11;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta')/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{19}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<14.2 \times 10^{-6}$	90	⁴⁶ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\eta'$

NODE=M059R12
NODE=M059R12

⁴⁶ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

NODE=M059R12;LINKAGE=CR

$$\Gamma(\eta_c(2S) \rightarrow \pi^+\pi^-\eta_c(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\eta_c(2S))/\Gamma_{\text{total}}$$

$$\Gamma_{20}/\Gamma \times \Gamma_{157}^{\psi(2S)}/\Gamma_{\psi(2S)}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-4}$	90	⁴⁷ CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\eta_c(1S)$

NODE=M059R14
NODE=M059R14

⁴⁷ Assuming $\Gamma(\eta_c(2S)) = 14$ MeV. CRONIN-HENNESSY 10 gives the analytic dependence of limits on width.

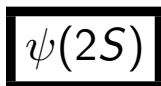
NODE=M059R14;LINKAGE=CR

$\eta_c(2S)$ REFERENCES

CHILIKIN	19	PR D100 012001	K. Chilikin <i>et al.</i>	(BELLE Collab.)
XU	18	PR D98 072001	Q.N. Xu <i>et al.</i>	(BELLE 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	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)
LEES	14E	PR D89 112004	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	13K	PR D87 052005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12G	PRL 109 042003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ABLIKIM	11H	PR D84 091102	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DEL-AMO-SA...	11M	PR D84 012004	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
VINOKUROVA	11	PL B706 139	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
CRONIN-HEN...	10	PR D81 052002	D. Cronin-Hennessey <i>et al.</i>	(CLEO Collab.)
AUBERT	08AB	PR D78 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)
UEHARA	08	EPJ C53 1	S. Uehara <i>et al.</i>	(BELLE Collab.)
WICHT	08	PL B662 323	J. Wicht <i>et al.</i>	(BELLE Collab.)
ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05C	PR D72 031101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	04D	PRL 92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AMBROGIANI	01	PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
LEE	85	SLAC 282	R.A. Lee	(SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)

NODE=M059

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REFID=40589
REFID=22173



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

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

$\psi(2S)$ MASS

OUR FIT includes measurements of $m_{\psi(2S)}$, $m_{\psi(3770)}$, and $m_{\psi(3770)} - m_{\psi(2S)}$.

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3686.10 ± 0.06 OUR FIT		Error includes scale factor of 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. • • •				
3686.114 ± 0.007 ^{+0.011} _{-0.016}		⁴ 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	⁵ ZHOLENTZ 80	OLYA	e^+e^-

¹Supersedes AULCHENKO 03 and ANASHIN 12.

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 $J/\psi(1S)$ mass from AULCHENKO 03.

⁴From 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.

⁵Superseded by ARTAMONOV 00.

$m_{\psi(2S)} - m_{J/\psi(1S)}$

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^-

¹Redundant with data in mass above.

²Systematic errors not evaluated.

$\psi(2S)$ WIDTH

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
294 ± 8 OUR 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	$\bar{p}p \rightarrow e^+e^-$

¹From 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.

²The initial-state radiation correction reevaluated by ANDREOTTI 07 in its Ref. [4].

NODE=M071

NODE=M071

NODE=M071M

NODE=M071M

NODE=M071M

NODE=M071M;LINKAGE=A
NODE=M071M;LINKAGE=AR

NODE=M071M;LINKAGE=NW

NODE=M071M;LINKAGE=AN

NODE=M071M;LINKAGE=RZ

NODE=M071DM

NODE=M071DM

NODE=M071DM;LINKAGE=R
NODE=M071DM;LINKAGE=BD

NODE=M071W

NODE=M071W

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) %	
Γ_2 virtual $\gamma \rightarrow$ hadrons	(1.73 $\pm$ 0.14) %	S=1.5
Γ_3 $g g g$	(10.6 $\pm$ 1.6) %	
Γ_4 $\gamma g g$	(1.03 $\pm$ 0.29) %	
Γ_5 light hadrons	(15.4 $\pm$ 1.5) %	
Γ_6 $e^+ e^-$	(7.93 $\pm$ 0.17) $\times 10^{-3}$	
Γ_7 $\mu^+ \mu^-$	(8.0 $\pm$ 0.6) $\times 10^{-3}$	
Γ_8 $\tau^+ \tau^-$	(3.1 $\pm$ 0.4) $\times 10^{-3}$	

DESIG=3
DESIG=4
DESIG=255
DESIG=256
DESIG=226
DESIG=1
DESIG=2
DESIG=68

Decays into $J/\psi(1S)$ and anything

Γ_9 $J/\psi(1S)$ anything	(61.4 $\pm$ 0.6) %
Γ_{10} $J/\psi(1S)$ neutrals	(25.38 $\pm$ 0.32) %
Γ_{11} $J/\psi(1S) \pi^+ \pi^-$	(34.68 $\pm$ 0.30) %
Γ_{12} $J/\psi(1S) \pi^0 \pi^0$	(18.24 $\pm$ 0.31) %
Γ_{13} $J/\psi(1S) \eta$	(3.37 $\pm$ 0.05) %
Γ_{14} $J/\psi(1S) \pi^0$	(1.268 $\pm$ 0.032) $\times 10^{-3}$

NODE=M071;CLUMP=A
DESIG=11
DESIG=12
DESIG=13
DESIG=14
DESIG=15
DESIG=18

Hadronic decays

Γ_{15} $\pi^0 h_c(1P)$	(8.6 $\pm$ 1.3) $\times 10^{-4}$	
Γ_{16} $3(\pi^+ \pi^-) \pi^0$	(3.5 $\pm$ 1.6) $\times 10^{-3}$	
Γ_{17} $2(\pi^+ \pi^-) \pi^0$	(2.9 $\pm$ 1.0) $\times 10^{-3}$	S=4.7
Γ_{18} $\rho a_2(1320)$	(2.6 $\pm$ 0.9) $\times 10^{-4}$	
Γ_{19} $\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	(5.3 $\pm$ 0.9) $\times 10^{-3}$	
Γ_{20} $\rho^\pm \pi^\mp \pi^0 \pi^0$	< 2.7 $\times 10^{-3}$	CL=90%
Γ_{21} $p \bar{p}$	(2.94 $\pm$ 0.08) $\times 10^{-4}$	
Γ_{22} $n \bar{n}$	(3.06 $\pm$ 0.15) $\times 10^{-4}$	
Γ_{23} $\Delta^{++} \bar{\Delta}^{--}$	(1.28 $\pm$ 0.35) $\times 10^{-4}$	
Γ_{24} $\Lambda \bar{\Lambda} \pi^0$	< 2.9 $\times 10^{-6}$	CL=90%
Γ_{25} $\Lambda \bar{\Lambda} \eta$	(2.5 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{26} $\Lambda \bar{p} K^+$	(1.00 $\pm$ 0.14) $\times 10^{-4}$	
Γ_{27} $K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	(6.3 $\pm$ 0.7) $\times 10^{-5}$	
Γ_{28} $\Lambda \bar{p} K^+ \pi^+ \pi^-$	(1.8 $\pm$ 0.4) $\times 10^{-4}$	
Γ_{29} $\Lambda \bar{\Lambda} \pi^+ \pi^-$	(2.8 $\pm$ 0.6) $\times 10^{-4}$	
Γ_{30} $\Lambda \bar{\Lambda}$	(3.81 $\pm$ 0.13) $\times 10^{-4}$	S=1.4
Γ_{31} $\Lambda \bar{\Sigma}^+ \pi^- + \text{c.c.}$	(1.40 $\pm$ 0.13) $\times 10^{-4}$	
Γ_{32} $\Lambda \bar{\Sigma}^- \pi^+ + \text{c.c.}$	(1.54 $\pm$ 0.14) $\times 10^{-4}$	
Γ_{33} $\Lambda \bar{\Sigma}^0$	(1.23 $\pm$ 0.24) $\times 10^{-5}$	
Γ_{34} $\Sigma^0 \bar{p} K^+ + \text{c.c.}$	(1.67 $\pm$ 0.18) $\times 10^{-5}$	
Γ_{35} $\Sigma^+ \bar{\Sigma}^-$	(2.32 $\pm$ 0.12) $\times 10^{-4}$	
Γ_{36} $\Sigma^0 \bar{\Sigma}^0$	(2.35 $\pm$ 0.09) $\times 10^{-4}$	S=1.1
Γ_{37} $\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	(8.5 $\pm$ 0.7) $\times 10^{-5}$	
Γ_{38} $\Sigma(1385)^- \bar{\Sigma}(1385)^+$	(8.5 $\pm$ 0.8) $\times 10^{-5}$	
Γ_{39} $\Sigma(1385)^0 \bar{\Sigma}(1385)^0$	(6.9 $\pm$ 0.7) $\times 10^{-5}$	
Γ_{40} $\Xi^- \Xi^+$	(2.87 $\pm$ 0.11) $\times 10^{-4}$	S=1.1
Γ_{41} $\Xi^0 \Xi^0$	(2.3 $\pm$ 0.4) $\times 10^{-4}$	S=4.2
Γ_{42} $\Xi(1530)^0 \Xi(1530)^0$	(5.2 $\pm$ 3.2 $\pm$ 1.2) $\times 10^{-5}$	
Γ_{43} $K^- \Lambda \Xi^+ + \text{c.c.}$	(3.9 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{44} $\Xi(1530)^- \Xi(1530)^+$	(1.15 $\pm$ 0.07) $\times 10^{-4}$	
Γ_{45} $\Xi(1530)^- \Xi^+$	(7.0 $\pm$ 1.2) $\times 10^{-6}$	
Γ_{46} $\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$	(5.2 $\pm$ 1.6) $\times 10^{-6}$	
Γ_{47} $\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$	(1.20 $\pm$ 0.32) $\times 10^{-5}$	
Γ_{48} $K^- \Sigma^0 \Xi^+ + \text{c.c.}$	(3.7 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{49} $\Omega^- \bar{\Omega}^+$	(5.2 $\pm$ 0.4) $\times 10^{-5}$	
Γ_{50} $\pi^0 p \bar{p}$	(1.53 $\pm$ 0.07) $\times 10^{-4}$	
Γ_{51} $N(940) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	(6.4 $\pm$ 1.8 $\pm$ 1.3) $\times 10^{-5}$	

NODE=M071;CLUMP=B
DESIG=254
DESIG=37
DESIG=25
DESIG=65
DESIG=312
DESIG=315
DESIG=27
DESIG=309
DESIG=70
DESIG=238
DESIG=239
DESIG=214
DESIG=321
DESIG=215
DESIG=213
DESIG=28
DESIG=280
DESIG=281
DESIG=307
DESIG=274
DESIG=223
DESIG=71
DESIG=72
DESIG=297
DESIG=299
DESIG=29
DESIG=224
DESIG=73
DESIG=293
DESIG=322
DESIG=323
DESIG=294
DESIG=295
DESIG=296
DESIG=74
DESIG=35
DESIG=267

Г ₅₂	$N(1440)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(7.3 \quad {}^{+1.7}_{-1.5}) \times 10^{-5}$	S=2.5	DESIG=261
Г ₅₃	$N(1520)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(6.4 \quad {}^{+2.3}_{-1.8}) \times 10^{-6}$		DESIG=268
Г ₅₄	$N(1535)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.5 \quad \pm 1.0) \times 10^{-5}$		DESIG=269
Г ₅₅	$N(1650)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(3.8 \quad {}^{+1.4}_{-1.7}) \times 10^{-5}$		DESIG=270
Г ₅₆	$N(1720)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(1.79 \quad {}^{+0.26}_{-0.70}) \times 10^{-5}$		DESIG=271
Г ₅₇	$N(2300)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.6 \quad {}^{+1.2}_{-0.7}) \times 10^{-5}$		DESIG=272
Г ₅₈	$N(2570)\bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p}$	$(2.13 \quad {}^{+0.40}_{-0.31}) \times 10^{-5}$		DESIG=273
Г ₅₉	$\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}$	$(1.1 \quad \pm 0.4) \times 10^{-5}$		DESIG=262
Г ₆₀	$\eta p \bar{p}$	$(6.0 \quad \pm 0.4) \times 10^{-5}$		DESIG=200
Г ₆₁	$\eta f_0(2100) \rightarrow \eta p \bar{p}$	$(1.2 \quad \pm 0.4) \times 10^{-5}$		DESIG=263
Г ₆₂	$N(1535)\bar{p} \rightarrow \eta p \bar{p}$	$(4.4 \quad \pm 0.7) \times 10^{-5}$		DESIG=264
Г ₆₃	$\omega p \bar{p}$	$(6.9 \quad \pm 2.1) \times 10^{-5}$		DESIG=77
Г ₆₄	$\eta' p \bar{p}$	$(1.10 \quad \pm 0.13) \times 10^{-5}$		DESIG=317
Г ₆₅	$\phi p \bar{p}$	$(6.1 \quad \pm 0.6) \times 10^{-6}$		DESIG=80
Г ₆₆	$\phi X(1835) \rightarrow \phi p \bar{p}$	$< 1.82 \quad \times 10^{-7}$	CL=90%	DESIG=318
Г ₆₇	$\pi^+ \pi^- p \bar{p}$	$(6.0 \quad \pm 0.4) \times 10^{-4}$		DESIG=31
Г ₆₈	$p \bar{n} \pi^- \text{ or c.c.}$	$(2.48 \quad \pm 0.17) \times 10^{-4}$		DESIG=227
Г ₆₉	$p \bar{n} \pi^- \pi^0$	$(3.2 \quad \pm 0.7) \times 10^{-4}$		DESIG=228
Г ₇₀	$2(\pi^+ \pi^- \pi^0)$	$(4.8 \quad \pm 1.5) \times 10^{-3}$		DESIG=221
Г ₇₁	$\eta \pi^+ \pi^-$	$< 1.6 \quad \times 10^{-4}$	CL=90%	DESIG=202
Г ₇₂	$\eta \pi^+ \pi^- \pi^0$	$(9.5 \quad \pm 1.7) \times 10^{-4}$		DESIG=203
Г ₇₃	$2(\pi^+ \pi^-) \eta$	$(1.2 \quad \pm 0.6) \times 10^{-3}$		DESIG=251
Г ₇₄	$\pi^+ \pi^- \pi^0 \pi^0 \eta$	$< 4 \quad \times 10^{-4}$	CL=90%	DESIG=313
Г ₇₅	$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \quad \pm 2.1) \times 10^{-4}$		DESIG=204
Г ₇₆	$\omega \pi^+ \pi^-$	$(7.3 \quad \pm 1.2) \times 10^{-4}$	S=2.1	DESIG=75
Г ₇₇	$b_1^\pm \pi^\mp$	$(4.0 \quad \pm 0.6) \times 10^{-4}$	S=1.1	DESIG=40
Г ₇₈	$b_1^0 \pi^0$	$(2.4 \quad \pm 0.6) \times 10^{-4}$		DESIG=193
Г ₇₉	$\omega f_2(1270)$	$(2.2 \quad \pm 0.4) \times 10^{-4}$		DESIG=64
Г ₈₀	$\omega \pi^0 \pi^0$	$(1.11 \quad \pm 0.35) \times 10^{-3}$		DESIG=314
Г ₈₁	$\pi^0 \pi^0 K^+ K^-$	$(2.6 \quad \pm 1.3) \times 10^{-4}$		DESIG=298
Г ₈₂	$\pi^+ \pi^- K^+ K^-$	$(7.3 \quad \pm 0.5) \times 10^{-4}$		DESIG=26
Г ₈₃	$\pi^0 \pi^0 K_S^0 K_L^0$	$(1.3 \quad \pm 0.6) \times 10^{-3}$		DESIG=304
Г ₈₄	$\rho^0 K^+ K^-$	$(2.2 \quad \pm 0.4) \times 10^{-4}$		DESIG=205
Г ₈₅	$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \quad \pm 0.5) \times 10^{-4}$		DESIG=66
Г ₈₆	$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \quad \pm 0.7) \times 10^{-3}$		DESIG=252
Г ₈₇	$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \quad \pm 0.31) \times 10^{-3}$		DESIG=240
Г ₈₈	$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \quad \pm 0.9) \times 10^{-3}$		DESIG=222
Г ₈₉	$K_1(1270)^\pm K^\mp$	$(1.00 \quad \pm 0.28) \times 10^{-3}$		DESIG=41
Г ₉₀	$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \quad \pm 0.4) \times 10^{-4}$		DESIG=225
Г ₉₁	$\rho^0 p \bar{p}$	$(5.0 \quad \pm 2.2) \times 10^{-5}$		DESIG=210
Г ₉₂	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \quad \pm 2.5) \times 10^{-4}$		DESIG=34
Г ₉₃	$2(\pi^+ \pi^-)$	$(2.4 \quad \pm 0.6) \times 10^{-4}$	S=2.2	DESIG=24
Г ₉₄	$\rho^0 \pi^+ \pi^-$	$(2.2 \quad \pm 0.6) \times 10^{-4}$	S=1.4	DESIG=33
Г ₉₅	$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \quad \pm 0.09) \times 10^{-3}$		DESIG=206
Г ₉₆	$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \quad \pm 2.2) \times 10^{-5}$		DESIG=216
Г ₉₇	$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \quad \pm 2.2) \times 10^{-4}$		DESIG=217
Г ₉₈	$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \quad \pm 2.8) \times 10^{-4}$		DESIG=218
Г ₉₉	$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \quad \pm 2.6) \times 10^{-4}$		DESIG=219
Г ₁₀₀	$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \quad \pm 1.8) \times 10^{-4}$		DESIG=220
Г ₁₀₁	$\eta K^+ K^-$, no $\eta \phi$	$(3.49 \quad \pm 0.17) \times 10^{-5}$		DESIG=207
Г ₁₀₂	$\omega K^+ K^-$	$(1.62 \quad \pm 0.11) \times 10^{-4}$	S=1.1	DESIG=76
Г ₁₀₃	$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \quad \pm 0.26) \times 10^{-4}$		DESIG=276
Г ₁₀₄	$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \quad \pm 1.2) \times 10^{-5}$		DESIG=277
Г ₁₀₅	$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \quad \pm 0.30) \times 10^{-4}$		DESIG=278

Γ_{106}	$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		DESIG=279
Γ_{107}	$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ +$ c.c.	$(1.6 \pm 0.4) \times 10^{-5}$		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}	$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8	DESIG=32
Γ_{112}	$p \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$		DESIG=211
Γ_{113}	$K^+ K^-$	$(7.5 \pm 0.5) \times 10^{-5}$		DESIG=23
Γ_{114}	$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$		DESIG=85
Γ_{115}	$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7	DESIG=36
Γ_{116}	$\rho(2150) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \pm 1.2_{-0.4}) \times 10^{-4}$		DESIG=201
Γ_{117}	$\rho(770) \pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8	DESIG=22
Γ_{118}	$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$		DESIG=21
Γ_{119}	$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90%	DESIG=42
Γ_{120}	$K_2^*(1430)^\pm K^\mp$	$(7.1 \pm 1.3_{-0.9}) \times 10^{-5}$		DESIG=265
Γ_{121}	$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$		DESIG=38
Γ_{122}	$K_S^0 K_L^0 \pi^0$	$< 3.0 \times 10^{-4}$	CL=90%	DESIG=303
Γ_{123}	$K_S^0 K_L^0 \eta$	$(1.3 \pm 0.5) \times 10^{-3}$		DESIG=305
Γ_{124}	$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2	DESIG=39
Γ_{125}	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$		DESIG=194
Γ_{126}	$\phi \pi^+ \pi^-$	$(1.18 \pm 0.26) \times 10^{-4}$	S=1.5	DESIG=78
Γ_{127}	$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(7.5 \pm 3.3) \times 10^{-5}$	S=1.6	DESIG=81
Γ_{128}	$2(K^+ K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$		DESIG=208
Γ_{129}	$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$		DESIG=79
Γ_{130}	$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$		DESIG=209
Γ_{131}	$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$		DESIG=89
Γ_{132}	$\eta \phi(2170), \phi(2170) \rightarrow$ $\phi f_0(980), f_0 \rightarrow \pi^+ \pi^-$	$< 2.2 \times 10^{-6}$	CL=90%	DESIG=316
Γ_{133}	$\phi \eta'$	$(1.54 \pm 0.20) \times 10^{-5}$		DESIG=90
Γ_{134}	$\phi f_1(1285)$	$(3.0 \pm 1.3) \times 10^{-5}$		DESIG=319
Γ_{135}	$\phi \eta(1405) \rightarrow \phi \pi^+ \pi^- \eta$	$(8.5 \pm 1.7) \times 10^{-6}$		DESIG=320
Γ_{136}	$\omega \eta'$	$(3.2 \pm 2.5_{-2.1}) \times 10^{-5}$		DESIG=91
Γ_{137}	$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		DESIG=92
Γ_{138}	$\rho \eta'$	$(1.9 \pm 1.7_{-1.2}) \times 10^{-5}$		DESIG=93
Γ_{139}	$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1	DESIG=94
Γ_{140}	$\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90%	DESIG=95
Γ_{141}	$\phi \pi^0$	$< 4 \times 10^{-7}$	CL=90%	DESIG=96
Γ_{142}	$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	DESIG=229
Γ_{143}	$p \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		DESIG=212
Γ_{144}	$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$		DESIG=237
Γ_{145}	$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		DESIG=67
Γ_{146}	$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 8.8 \times 10^{-6}$	CL=90%	DESIG=195
Γ_{147}	$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 1.0 \times 10^{-5}$	CL=90%	DESIG=196
Γ_{148}	$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 7.0 \times 10^{-6}$	CL=90%	DESIG=197
Γ_{149}	$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 2.6 \times 10^{-5}$	CL=90%	DESIG=198
Γ_{150}	$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 6.0 \times 10^{-6}$	CL=90%	DESIG=199
Γ_{151}	$K_S^0 K_S^0$	$< 4.6 \times 10^{-6}$		DESIG=86
Γ_{152}	$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	$< 1.7 \times 10^{-6}$	CL=90%	DESIG=310

Radiative decays

NODE=M071;CLUMP=C

Γ_{153}	$\gamma\chi_{c0}(1P)$	(9.79 $\pm$ 0.20) %		DESIG=56
Γ_{154}	$\gamma\chi_{c1}(1P)$	(9.75 $\pm$ 0.24) %		DESIG=58
Γ_{155}	$\gamma\chi_{c2}(1P)$	(9.52 $\pm$ 0.20) %		DESIG=59
Γ_{156}	$\gamma\eta_c(1S)$	(3.4 $\pm$ 0.5) $\times 10^{-3}$	S=1.3	DESIG=61
Γ_{157}	$\gamma\eta_c(2S)$	(7 $\pm$ 5) $\times 10^{-4}$		DESIG=63
Γ_{158}	$\gamma\pi^0$	(1.04 $\pm$ 0.22) $\times 10^{-6}$	S=1.4	DESIG=52
Γ_{159}	$\gamma\eta'(958)$	(1.24 $\pm$ 0.04) $\times 10^{-4}$		DESIG=54
Γ_{160}	$\gamma f_2(1270)$	(2.73 $^{+0.29}_{-0.25}$) $\times 10^{-4}$	S=1.8	DESIG=82
Γ_{161}	$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	(3.1 $\pm$ 1.7) $\times 10^{-5}$		DESIG=286
Γ_{162}	$\gamma f_0(1500)$	(9.3 $\pm$ 1.9) $\times 10^{-5}$		DESIG=287
Γ_{163}	$\gamma f'_2(1525)$	(3.3 $\pm$ 0.8) $\times 10^{-5}$		DESIG=288
Γ_{164}	$\gamma f_0(1710)$			DESIG=236
Γ_{165}	$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	(3.5 $\pm$ 0.6) $\times 10^{-5}$		DESIG=83
Γ_{166}	$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	(6.6 $\pm$ 0.7) $\times 10^{-5}$		DESIG=84
Γ_{167}	$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	(4.8 $\pm$ 1.0) $\times 10^{-6}$		DESIG=289
Γ_{168}	$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	(3.2 $\pm$ 1.0) $\times 10^{-6}$		DESIG=290
Γ_{169}	$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 5.8 $\times 10^{-6}$	CL=90%	DESIG=291
Γ_{170}	$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 9.5 $\times 10^{-6}$	CL=90%	DESIG=292
Γ_{171}	$\gamma\gamma$	< 1.5 $\times 10^{-4}$	CL=90%	DESIG=51
Γ_{172}	$\gamma\eta$	(9.2 $\pm$ 1.8) $\times 10^{-7}$		DESIG=53
Γ_{173}	$\gamma\eta\pi^+\pi^-$	(8.7 $\pm$ 2.1) $\times 10^{-4}$		DESIG=230
Γ_{174}	$\gamma\eta(1405)$			DESIG=231
Γ_{175}	$\gamma\eta(1405) \rightarrow \gamma K \bar{K} \pi$	< 9 $\times 10^{-5}$	CL=90%	DESIG=62
Γ_{176}	$\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-$	(3.6 $\pm$ 2.5) $\times 10^{-5}$		DESIG=232
Γ_{177}	$\gamma\eta(1405) \rightarrow \gamma f_0(980)\pi^0 \rightarrow \gamma\pi^+\pi^-\pi^0$	< 5.0 $\times 10^{-7}$	CL=90%	DESIG=308
Γ_{178}	$\gamma\eta(1475)$			DESIG=233
Γ_{179}	$\gamma\eta(1475) \rightarrow K \bar{K} \pi$	< 1.4 $\times 10^{-4}$	CL=90%	DESIG=234
Γ_{180}	$\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-$	< 8.8 $\times 10^{-5}$	CL=90%	DESIG=235
Γ_{181}	$\gamma 2(\pi^+\pi^-)$	(4.0 $\pm$ 0.6) $\times 10^{-4}$		DESIG=241
Γ_{182}	$\gamma K^{*0} K^+\pi^- + \text{c.c.}$	(3.7 $\pm$ 0.9) $\times 10^{-4}$		DESIG=242
Γ_{183}	$\gamma K^{*0} \bar{K}^{*0}$	(2.4 $\pm$ 0.7) $\times 10^{-4}$		DESIG=243
Γ_{184}	$\gamma K_S^0 K^+\pi^- + \text{c.c.}$	(2.6 $\pm$ 0.5) $\times 10^{-4}$		DESIG=244
Γ_{185}	$\gamma K^+ K^- \pi^+ \pi^-$	(1.9 $\pm$ 0.5) $\times 10^{-4}$		DESIG=245
Γ_{186}	$\gamma p \bar{p}$	(3.9 $\pm$ 0.5) $\times 10^{-5}$	S=2.0	DESIG=246
Γ_{187}	$\gamma f_2(1950) \rightarrow \gamma p \bar{p}$	(1.20 $\pm$ 0.22) $\times 10^{-5}$		DESIG=257
Γ_{188}	$\gamma f_2(2150) \rightarrow \gamma p \bar{p}$	(7.2 $\pm$ 1.8) $\times 10^{-6}$		DESIG=258
Γ_{189}	$\gamma X(1835) \rightarrow \gamma p \bar{p}$	(4.6 $^{+1.8}_{-4.0}$) $\times 10^{-6}$		DESIG=259
Γ_{190}	$\gamma X \rightarrow \gamma p \bar{p}$	[a] < 2 $\times 10^{-6}$	CL=90%	DESIG=260
Γ_{191}	$\gamma\pi^+\pi^- p \bar{p}$	(2.8 $\pm$ 1.4) $\times 10^{-5}$		DESIG=247
Γ_{192}	$\gamma 2(\pi^+\pi^-) K^+ K^-$	< 2.2 $\times 10^{-4}$	CL=90%	DESIG=248
Γ_{193}	$\gamma 3(\pi^+\pi^-)$	< 1.7 $\times 10^{-4}$	CL=90%	DESIG=249
Γ_{194}	$\gamma K^+ K^- K^+ K^-$	< 4 $\times 10^{-5}$	CL=90%	DESIG=250
Γ_{195}	$\gamma\gamma J/\psi$	(3.1 $^{+1.0}_{-1.2}$) $\times 10^{-4}$		DESIG=266
Γ_{196}	$e^+ e^- \eta'$	(1.90 $\pm$ 0.26) $\times 10^{-6}$		DESIG=311
Γ_{197}	$e^+ e^- \chi_{c0}(1P)$	(1.06 $\pm$ 0.24) $\times 10^{-3}$		DESIG=300
Γ_{198}	$e^+ e^- \chi_{c1}(1P)$	(8.5 $\pm$ 0.6) $\times 10^{-4}$		DESIG=301
Γ_{199}	$e^+ e^- \chi_{c2}(1P)$	(7.0 $\pm$ 0.8) $\times 10^{-4}$		DESIG=302

Weak decaysNODE=M071;CLUMP=E
DESIG=306

Γ_{200}	$D^0 e^+ e^- + \text{c.c.}$	< 1.4 $\times 10^{-7}$	CL=90%

Other decaysNODE=M071;CLUMP=D
DESIG=275

Γ_{201}	invisible	< 1.6 %	CL=90%

[a] For a narrow resonance in the range $2.2 < M(X) < 2.8$ 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 84 branching ratios uses 248 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 378.1$ for 199 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_7	3									
x_8	1	0								
x_{11}	29	11	2							
x_{12}	28	6	1	48						
x_{13}	13	4	1	36	15					
x_{21}	0	0	0	4	3	2				
x_{153}	1	0	0	2	1	1	0			
x_{154}	1	0	0	2	1	1	0	0		
x_{155}	1	0	0	3	1	1	0	0	0	
Γ	-81	-4	-1	-38	-34	-16	-7	-1	-1	-1
	x_6	x_7	x_8	x_{11}	x_{12}	x_{13}	x_{21}	x_{153}	x_{154}	x_{155}

$\psi(2S)$ 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_6

VALUE (keV)	DOCUMENT ID	TECN	COMMENT

2.33 ± 0.04 OUR FIT**2.29 ± 0.06 OUR AVERAGE**

$2.23 \pm 0.10 \pm 0.02$	¹ ABLIKIM	15V	BES3	$4.0\text{--}4.4 e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$2.338 \pm 0.037 \pm 0.096$	ABLIKIM	08B	BES2	$e^+e^- \rightarrow \text{hadrons}$
$2.330 \pm 0.036 \pm 0.110$	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 Υ mini-review

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

$2.279 \pm 0.015 \pm 0.042$	³ ANASHIN	18	KEDR	e^+e^-
$2.282 \pm 0.015 \pm 0.042$	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^-

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 $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. 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_{171}

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

 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_1\Gamma_6/\Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
2.233±0.015±0.042	¹ ANASHIN	12 KEDR	$e^+e^- \rightarrow \text{hadrons}$

NODE=M071G3
 NODE=M071G3

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

2.2 ± 0.4 ABRAMS 75 MRK1 e^+e^-

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

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

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

 $\Gamma(\mu^+\mu^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_7\Gamma_6/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
19.3±0.3±0.5	¹ ANASHIN	18 KEDR	$\psi(2S) \rightarrow \mu^+\mu^-$

NODE=M071P13
 NODE=M071P13

¹ From the average of nine scans of the $\psi(2S)$.

NODE=M071P13;LINKAGE=A

 $\Gamma(\tau^+\tau^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_8\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M071G9
 NODE=M071G9

• • • 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;LINKAGE=AN

 $\Gamma(J/\psi(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{11}\Gamma_6/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT

NODE=M071G1
 NODE=M071G1

0.808±0.013 OUR FIT**0.837±0.025 OUR AVERAGE** Error includes scale factor of 1.3. See the ideogram below.

0.837±0.028±0.005 ¹ 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 ² BAI 98E BES e^+e^-

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

0.88 ± 0.08 ± 0.03 256 ³ AUBERT 07AU BABR 10.6 $e^+e^- \rightarrow J/\psi\pi^+\pi^-\gamma$

0.755±0.048±0.004 544 ⁴ AUBERT 05D BABR 10.6 $e^+e^- \rightarrow \pi^+\pi^-\mu^+\mu^-\gamma$

¹ 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.

NODE=M071G1;LINKAGE=LE

² 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 $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

NODE=M071G1;LINKAGE=A

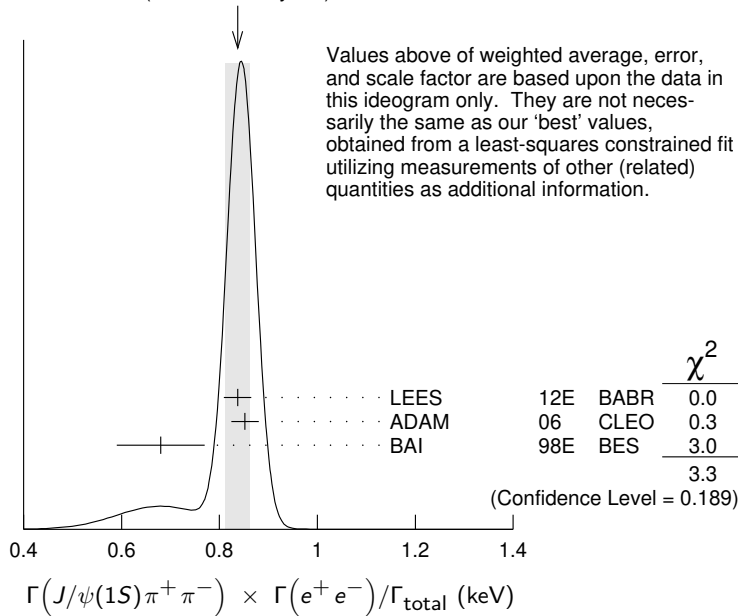
³ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)] = 0.0186 \pm 0.0012 \pm 0.0011$ keV which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.10 \pm 0.08) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G1;LINKAGE=UB

⁴ 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;LINKAGE=AU

WEIGHTED AVERAGE
0.837±0.025 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{12}\Gamma_6/\Gamma$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.425±0.009 OUR FIT				
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. • • •				
0.48 ±0.09 ±0.02	142	¹ LEES	18E BABR	10.6 $e^+e^- \rightarrow J/\psi\pi^0\pi^0\gamma$

¹ LEES 18E reports $[\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0)] = 0.0101 \pm 0.0015 \pm 0.0011 \text{ keV}$ which we divide by our best value $B(J/\psi(1S) \rightarrow \pi^+\pi^-\pi^0) = (2.10 \pm 0.08) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G6
NODE=M071G6

NODE=M071G6;LINKAGE=A

$\Gamma(J/\psi(1S)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{13}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
78.6± 1.6 OUR 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 $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow J/\psi\eta) \cdot B(J/\psi \rightarrow \mu^+\mu^-) \cdot B(\eta \rightarrow \pi^+\pi^-\pi^0) = 1.11 \pm 0.33 \pm 0.07 \text{ eV}$.				

NODE=M071G7
NODE=M071G7

NODE=M071G7;LINKAGE=UB

$\Gamma(J/\psi(1S)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{14}\Gamma_6/\Gamma$

VALUE (eV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<8	90	<37	ADAM	06	CLEO 3.773 $e^+e^- \rightarrow \gamma\psi(2S)$

NODE=M071G8
NODE=M071G8

$\Gamma(p\bar{p}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{21}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.686±0.019 OUR FIT				
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	$e^+e^- \rightarrow p\bar{p}\gamma$

NODE=M071G2
NODE=M071G2

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

$\Gamma(\Lambda\bar{\Lambda}) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{30}\Gamma_6/\Gamma$

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

$$\Gamma(2(\pi^+\pi^-\pi^0)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{70}\Gamma_6/\Gamma$$

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

$$\Gamma(\pi^0\pi^0K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{81}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.60±0.31±0.03	17	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^0\pi^0K^+K^-\gamma$

NODE=M071G08
NODE=M071G08

$$\Gamma(K^+K^-2(\pi^+\pi^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{88}\Gamma_6/\Gamma$$

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

$$\Gamma(\pi^+\pi^-K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{82}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
1.92±0.30±0.06	133	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M071G12
NODE=M071G12

• • • 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 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹ Superseded by LEES 12F.

NODE=M071G12;LINKAGE=A

$$\Gamma(\pi^0\pi^0K_S^0K_L^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{83}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
2.92±1.27±0.15	14	LEES	17A BABR	$e^+e^- \rightarrow K_S^0K_L^0\pi^0\pi^0\gamma$

NODE=M071G14
NODE=M071G14

$$\Gamma(K_S^0K_L^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{122}\Gamma_6/\Gamma$$

VALUE (eV)	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<0.7	90	8	LEES	17A BABR	$e^+e^- \rightarrow K_S^0K_L^0\pi^0\gamma$

NODE=M071G15
NODE=M071G15

$$\Gamma(K_S^0K_L^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{123}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
3.14±1.08±0.16	16	LEES	17A BABR	$e^+e^- \rightarrow K_S^0K_L^0\eta\gamma$

NODE=M071G16
NODE=M071G16

$$\Gamma(\phi f_0(980) \rightarrow \pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{127}\Gamma_6/\Gamma$$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
0.345±0.128±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. • • •

0.345±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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best 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 $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G13;LINKAGE=AU

$$\Gamma(2(K^+K^-)) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{128}\Gamma_6/\Gamma$$

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

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{126}\Gamma_6/\Gamma$$

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 $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.27 \pm 0.09 \pm 0.02 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=A

² Superseded by LEES 12F. AUBERT,BE 06D reports $[\Gamma(\psi(2S) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] = 0.28 \pm 0.11 \pm 0.02 \text{ eV}$ which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = (49.2 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G10;LINKAGE=AU

$\Gamma(2(\pi^+\pi^-)\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{17}\Gamma_6/\Gamma$

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=M071G01
NODE=M071G01

$\Gamma(\pi^+\pi^-\pi^0\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{19}\Gamma_6/\Gamma$

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

$\Gamma(\rho^\pm\pi^\mp\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{20}\Gamma_6/\Gamma$

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

$\Gamma(\omega\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{76}\Gamma_6/\Gamma$

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 $[\Gamma(\psi(2S) \rightarrow \omega\pi^+\pi^-) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.69 \pm 0.73 \pm 0.16 \text{ eV}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G02;LINKAGE=UB

$\Gamma(\omega\pi^0\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{80}\Gamma_6/\Gamma$

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 $[\Gamma(\psi(2S) \rightarrow \omega\pi^0\pi^0) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = 2.3 \pm 0.7 \pm 0.2 \text{ eV}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.3 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P17;LINKAGE=A

$\Gamma(2(\pi^+\pi^-)\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{73}\Gamma_6/\Gamma$

VALUE (eV)	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

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.13 \pm 0.55 \pm 0.08 \text{ eV}$ which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. 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

$\Gamma(\pi^+\pi^-\pi^0\pi^0\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{74}\Gamma_6/\Gamma$

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

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{95}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
4.4±1.3±0.3	32	AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\pi^0\gamma$

NODE=M071G04
NODE=M071G04

$\Gamma(K^+K^-\pi^+\pi^-\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{86}\Gamma_6/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
3.04±1.79±0.02	7	¹ AUBERT	07AU BABR	10.6 $e^+e^- \rightarrow K^+K^-\pi^+\pi^-\eta\gamma$

NODE=M071G05
NODE=M071G05

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+K^-\pi^+\pi^-\eta) \times \Gamma(\psi(2S) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\eta \rightarrow 2\gamma)] = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$ which we divide by our best value $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071G05;LINKAGE=UB

$$\Gamma(K^+K^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{113}\Gamma_6/\Gamma$$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.147 \pm 0.035 \pm 0.005$	66	¹ LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
$0.197 \pm 0.035 \pm 0.005$	66	² LEES	15J BABR	$e^+e^- \rightarrow K^+K^-\gamma$
$0.35 \pm 0.14 \pm 0.03$	11	³ LEES	13Q BABR	$e^+e^- \rightarrow K^+K^-\gamma$
¹ $\sin\phi > 0$.				
² $\sin\phi < 0$.				
³ Interference with non-resonant K^+K^- production not taken into account.				

NODE=M071G06
NODE=M071G06

OCCUR=2

NODE=M071G06;LINKAGE=A
NODE=M071G06;LINKAGE=B
NODE=M071G06;LINKAGE=BA

$$\psi(2S) \text{ BRANCHING RATIOS}$$

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
0.0173 ± 0.0014 OUR AVERAGE Error includes scale factor of 1.5.			
0.0166 ± 0.0010	^{1,2} SETH	04 RVUE	e^+e^-
0.0199 ± 0.0019	¹ BAI	02B BES2	e^+e^-
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.029 ± 0.004	¹ LUTH	75 MRK1	e^+e^-
¹ Included in $\Gamma(\text{hadrons})/\Gamma_{\text{total}}$.			
² 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.			

NODE=M071R5
NODE=M071R5

NODE=M071R;LINKAGE=Z
NODE=M071R5;LINKAGE=SE

$$\Gamma(ggg)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
10.58 ± 1.62	2.9 M	¹ LIBBY	09 CLEO	$\psi(2S) \rightarrow \text{hadrons}$
¹ Calculated using $\Gamma(\gamma gg)/\Gamma(ggg) = 0.097 \pm 0.026 \pm 0.016$ 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 $\Gamma(\gamma gg)/\Gamma_{\text{total}}$ LIBBY 09 measurement.				

NODE=M071S43
NODE=M071S43

NODE=M071S43;LINKAGE=LI

$$\Gamma(\gamma gg)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

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 $\Gamma(\gamma gg)/\Gamma(ggg) = 0.097 \pm 0.026 \pm 0.016$ from LIBBY 09. The statistical error is negligible and the systematic error is largely uncorrelated with that of $\Gamma(ggg)/\Gamma_{\text{total}}$ LIBBY 09 measurement.				

NODE=M071S44
NODE=M071S44

NODE=M071S44;LINKAGE=LI

$$\Gamma(\gamma gg)/\Gamma(ggg) \quad \Gamma_4/\Gamma_3$$

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

$$\Gamma(\text{light hadrons})/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.154 ± 0.015			
• • • 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_6/Γ VALUE (units 10^{-4})

DOCUMENT ID

TECN

COMMENT

79.3 ± 1.7 OUR 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

NODE=M071R;LINKAGE=L

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_7/Γ VALUE (units 10^{-4})

DOCUMENT ID

80 ± 6 OUR FIT

NODE=M071R2
NODE=M071R2

 $\Gamma(\mu^+\mu^-)/\Gamma(e^+e^-)$ Γ_7/Γ_6

VALUE

DOCUMENT ID

TECN

COMMENT

1.00 ± 0.08 OUR 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

 $\Gamma(\tau^+\tau^-)/\Gamma_{\text{total}}$ Γ_8/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

 $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}}$ Γ_9/Γ

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.614 ± 0.006 OUR 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. • • •

0.6254 ± 0.0016 ± 0.0155 1.1M

¹ MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-X$

0.5950 ± 0.0015 ± 0.0190 151k

ADAM 05A CLEO Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

NODE=M071R10
NODE=M071R10

NODE=M071R10;LINKAGE=ME

 $\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\text{anything})$ $\Gamma_6/\Gamma_9 = \Gamma_6/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.343\Gamma_{154} + 0.190\Gamma_{155})$ VALUE (units 10^{-2})

EVTS

DOCUMENT ID

TECN

COMMENT

1.291 ± 0.026 OUR FIT**1.28 ± 0.04 OUR AVERAGE** Error includes scale factor of 1.6. See the ideogram below.

1.22 ± 0.02 ± 0.05 5097 ± 73

¹ ANDREOTTI 05 E835 $p\bar{p} \rightarrow \psi(2S) \rightarrow$ e^+e^-

1.28 ± 0.03 ± 0.02

¹ AMBROGIANI 00A E835 $p\bar{p} \rightarrow \psi(2S)$

1.44 ± 0.08 ± 0.02

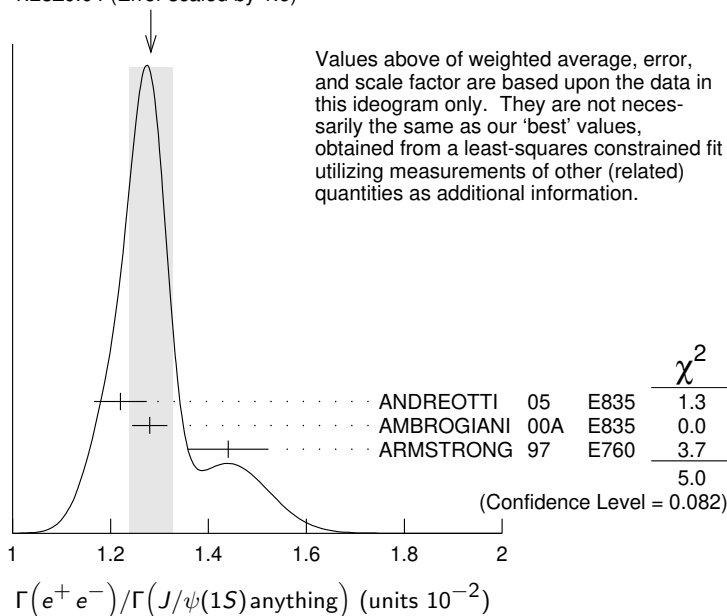
¹ ARMSTRONG 97 E760 $\bar{p}p \rightarrow \psi(2S)$

¹ Using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.

NODE=M071R72
NODE=M071R72

NODE=M071R;LINKAGE=7A

WEIGHTED AVERAGE
 1.28 ± 0.04 (Error scaled by 1.6)



$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\text{anything})$

$$\Gamma_7/\Gamma_9 = \Gamma_7/(\Gamma_{11} + \Gamma_{12} + \Gamma_{13} + 0.343\Gamma_{154} + 0.190\Gamma_{155})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.0130 ± 0.0010 OUR FIT			
0.014 ± 0.003	HILGER	75	SPEC e^+e^-

NODE=M071R74
 NODE=M071R74

$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID
0.2538 ± 0.0032 OUR FIT	

Γ_{10}/Γ

NODE=M071R18
 NODE=M071R18

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.3468 ± 0.0030 OUR FIT				

Γ_{11}/Γ

NODE=M071R12
 NODE=M071R12

0.348 ± 0.005 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

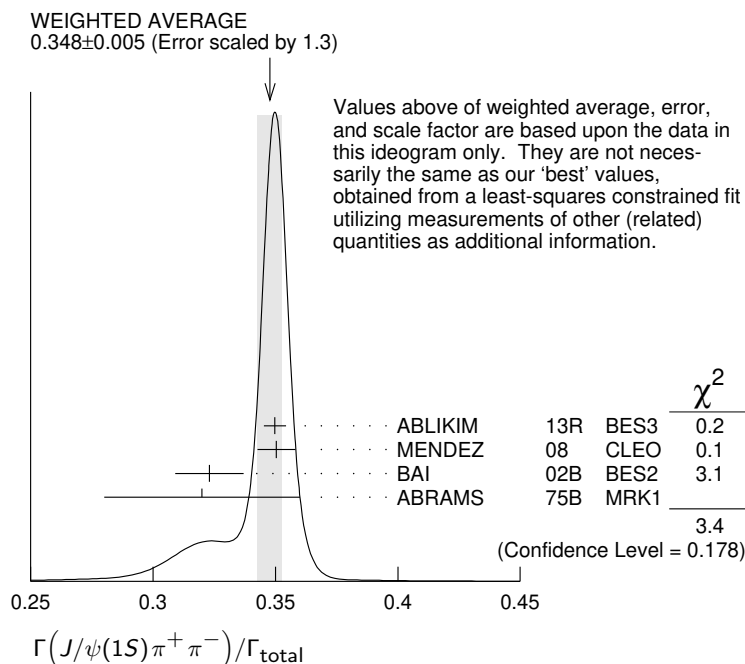
0.3498 ± 0.0002 ± 0.0045	20M	ABLIKIM	13R	BES3	$\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$
0.3504 ± 0.0007 ± 0.0077	565k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+ \ell^- \pi^+ \pi^-$
0.323 ± 0.014		BAI	02B	BES2	$e^+ e^-$
0.32 ± 0.04		ABRAMS	75B	MRK1	$e^+ e^- \rightarrow J/\psi \pi^+ \pi^-$

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

0.3354 ± 0.0014 ± 0.0110	60k	¹ ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other values reported by ADAM 05A.

NODE=M071R;LINKAGE=AD



$\Gamma(e^+e^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_6/Γ_{11}

VALUE	DOCUMENT ID	TECN	COMMENT
0.0229±0.0005 OUR 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

NODE=M071R73;LINKAGE=7A

$\Gamma(\mu^+\mu^-)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_7/Γ_{11}

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_8/Γ_{11}

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_{11}/Γ_9

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.5645±0.0026 OUR 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

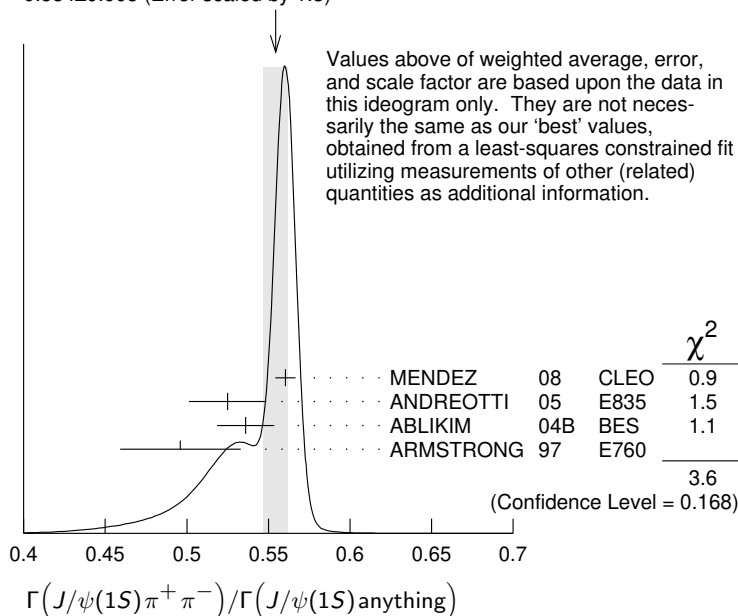
¹ From a fit to the J/ψ recoil mass spectra.

² ABLIKIM 04B quotes $B(\psi(2S) \rightarrow J/\psi X) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)$.

NODE=M071R70
NODE=M071R70

NODE=M071R;LINKAGE=AB
NODE=M071R;LINKAGE=AL

WEIGHTED AVERAGE
0.554±0.008 (Error scaled by 1.3)



$\Gamma(J/\psi(1S)\text{neutrals})/\Gamma(J/\psi(1S)\pi^+\pi^-)$

$$\Gamma_{10}/\Gamma_{11} = (0.9761\Gamma_{12} + 0.719\Gamma_{13} + 0.343\Gamma_{154} + 0.190\Gamma_{155})/\Gamma_{11}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.732±0.008 OUR FIT			
0.73 ±0.09	TANENBAUM 76	MRK1	e^+e^-

NODE=M071R11
NODE=M071R11

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma_{\text{total}}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.1824±0.0031 OUR FIT				

NODE=M071R17
NODE=M071R17

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

0.1769±0.0008±0.0053	61k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \ell^+\ell^-2\pi^0$
0.1652±0.0014±0.0058	13.4k	² ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

² Not independent from other values reported by ADAM 05A.

NODE=M071R17;LINKAGE=ME
NODE=M071R17;LINKAGE=AD

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.2968±0.0031 OUR FIT				

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	$p\bar{p} \rightarrow \psi(2S)$

• • • 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

NODE=M071R69
NODE=M071R69

$\Gamma(J/\psi(1S)\pi^0\pi^0)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.526 ±0.008 OUR FIT

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
NODE=M071R14

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_{13}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

33.7 ± 0.5 OUR 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 ¹OREGLIA 80 CBAL $e^+e^- \rightarrow J/\psi 2\gamma$ 45 ± 12 17 ²BRANDELIK 79B DASP $e^+e^- \rightarrow J/\psi 2\gamma$ 42 ± 6 164 ²BARTEL 78B CNTR e^+e^-

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

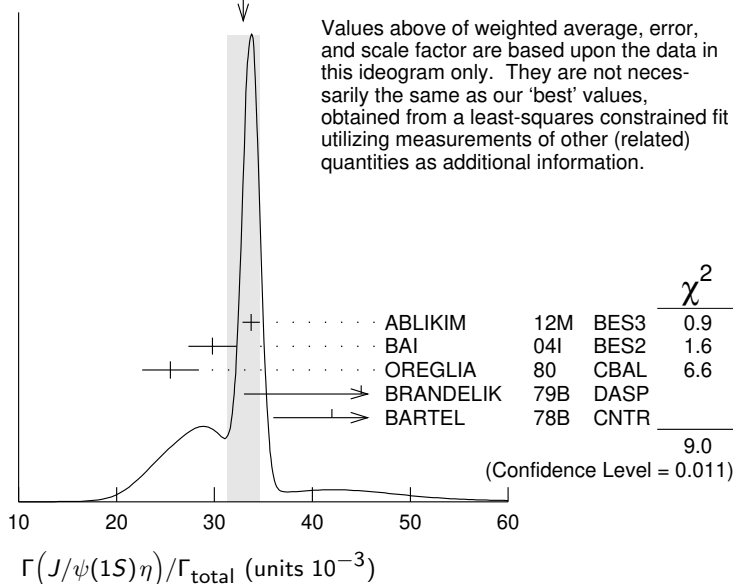
34.3 ± 0.4 ± 0.9 18.4k ³MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$ 32.5 ± 0.6 ± 1.1 2.8k ⁴ADAM 05A CLEO Repl. by MENDEZ 0843 ± 8 44 TANENBAUM 76 MRK1 e^+e^- ¹ Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.² Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.³ Not independent from other measurements of MENDEZ 08.⁴ Not independent from other values reported by ADAM 05A.NODE=M071R15
NODE=M071R15

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_{13}/Γ_9

VALUE

EVTS

DOCUMENT ID

TECN

COMMENT

0.0549 ± 0.0008 OUR 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 $\bar{p}p \rightarrow \psi(2S)$

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

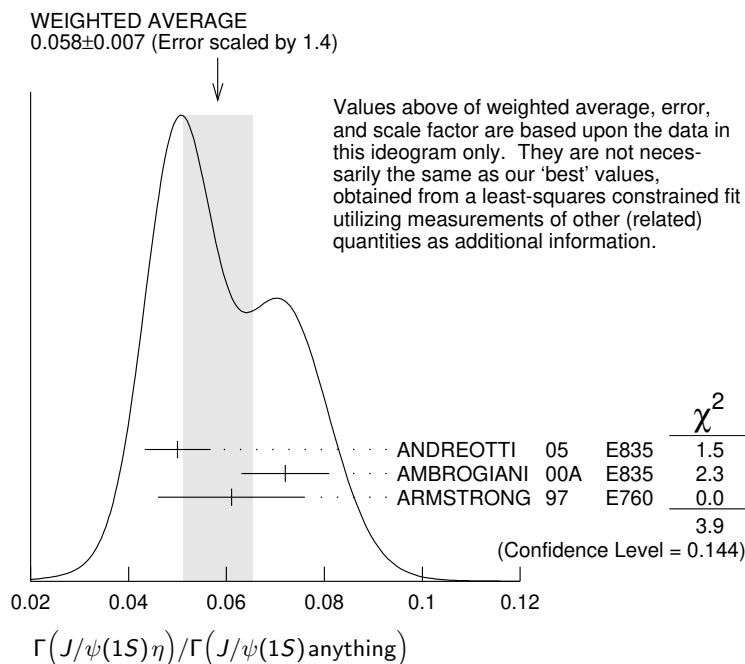
0.0549 ± 0.0006 ± 0.0009 18.4k ¹MENDEZ 08 CLEO $\psi(2S) \rightarrow \ell^+\ell^-\eta$

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

OCCUR=2

NODE=M071R68;LINKAGE=ME



$\Gamma(J/\psi(1S)\eta)/\Gamma(J/\psi(1S)\pi^+\pi^-)$

Γ_{13}/Γ_{11}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0972±0.0014 OUR 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

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_{14}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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;LINKAGE=3Q

$\Gamma(J/\psi(1S)\pi^0)/\Gamma(J/\psi(1S)\text{anything})$

$\Gamma_{14}/\Gamma_9 = \Gamma_{14}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13}+0.343\Gamma_{154}+0.190\Gamma_{155})$

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_{14}/Γ_{11}

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

 $\Gamma(\pi^0 h_c(1P))/\Gamma_{\text{total}}$
 Γ_{15}/Γ

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

8.6 ± 1.3 OUR AVERAGE

$9.0 \pm 1.5 \pm 1.3$	3k	¹ GE	11	CLEO $\psi(2S) \rightarrow \pi^0$ anything
$8.4 \pm 1.3 \pm 1.0$	11k	ABLIKIM	10B	BES3 $\psi(2S) \rightarrow \pi^0 h_c$

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

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 $B = (7.6 \pm 1.4 \times \Gamma(h_c(1P)/\Gamma_0) \times 10^{-4}$, and with a systematic error that accounts for the width variation range 0.43–1.29 MeV.

NODE=M071S42
NODE=M071S42

NODE=M071S42;LINKAGE=GE

 $\Gamma(3(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$
 Γ_{16}/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

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

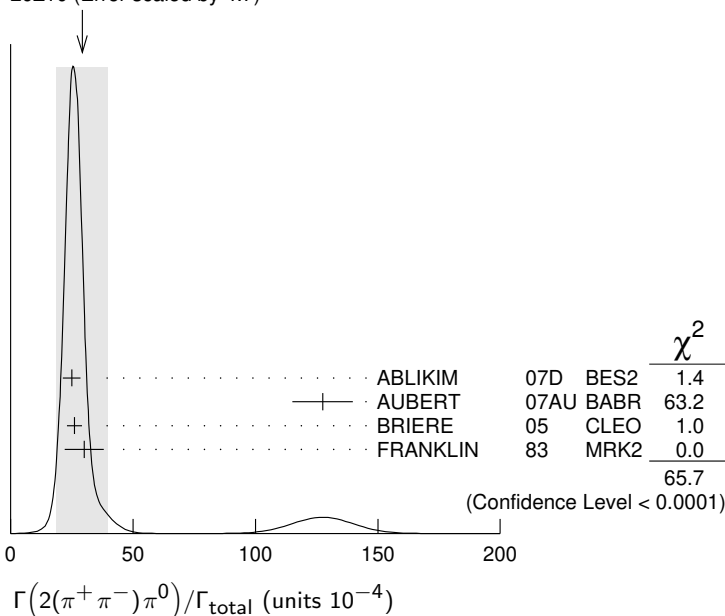
$24.9 \pm 0.7 \pm 3.6$	2173	ABLIKIM	07D	BES2 $e^+e^- \rightarrow \psi(2S)$
$127 \pm 12 \pm 2$	410	¹ AUBERT	07AU	BABR $10.6 e^+e^- \rightarrow 2(\pi^+\pi^-)\pi^0\gamma$
$26.1 \pm 0.7 \pm 3.0$	1703	BRIERE	05	CLEO $e^+e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$
30 ± 8	42	FRANKLIN	83	MRK2 e^+e^-

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (297 \pm 22 \pm 18) \times 10^{-4} \text{ keV}$ which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071R22
NODE=M071R22

NODE=M071R22;LINKAGE=UB

WEIGHTED AVERAGE
 29 ± 10 (Error scaled by 4.7)



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

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.55±0.73±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^-

 Γ_{18}/Γ NODE=M071R65
NODE=M071R65 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.94±0.08 OUR 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	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

 Γ_{21}/Γ NODE=M071R25
NODE=M071R25¹ Using CLEO-c data but not authored by the CLEO Collaboration.

NODE=M071R25;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma(J/\psi(1S)\pi^+\pi^-)$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
8.49±0.23 OUR FIT			
6.98±0.49±0.97	BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}$

 Γ_{21}/Γ_{11} NODE=M071S40
NODE=M071S40 $\Gamma(n\bar{n})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.06±0.06±0.14	6k	ABLIKIM	18T BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow n\bar{n}$

 Γ_{22}/Γ NODE=M071P10
NODE=M071P10 $\Gamma(\Delta^{++}\bar{\Delta}^{--})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
12.8±1.0±3.4	157	¹ BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow$ hadrons

 Γ_{23}/Γ NODE=M071R50
NODE=M071R50¹ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R50;LINKAGE=PP

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

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.29	90	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. • • •				
<12	90	² ABLIKIM	07H BES2	$e^+e^- \rightarrow \psi(2S)$

 Γ_{24}/Γ NODE=M071R6
NODE=M071R6¹ Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\pi^0 \rightarrow \gamma\gamma) = 98.8\%$.² Using $B(\Lambda \rightarrow \pi^- p) = 63.9\%$ and $B(\eta \rightarrow \gamma\gamma) = 39.4\%$.NODE=M071R6;LINKAGE=AL
NODE=M071R6;LINKAGE=AB $\Gamma(\Lambda\bar{\Lambda}\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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		$e^+e^- \rightarrow \psi(2S)$

 Γ_{25}/Γ NODE=M071R7
NODE=M071R7¹ 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;LINKAGE=AL
NODE=M071R7;LINKAGE=AB $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.0±0.1±0.1	74.0	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ $p\bar{p}K^+\pi^-$

 Γ_{26}/Γ NODE=M071S18
NODE=M071S18 $\Gamma(K^*(892)^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.3±0.5±0.5	1011	ABLIKIM	19AU BES3	$e^+e^- \rightarrow \psi(2S)$

 Γ_{27}/Γ NODE=M071P25
NODE=M071P25 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.8±0.3±0.3	45.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow$ $p\bar{p}K^+\pi^+\pi^-\pi^-$

 Γ_{28}/Γ NODE=M071S19
NODE=M071S19

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 0.4 \pm 0.5$	73.4	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \rho\bar{\rho}2(\pi^+\pi^-)$

 Γ_{29}/Γ

NODE=M071S17
 NODE=M071S17

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$

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.		
$3.97 \pm 0.02 \pm 0.12$	31k		ABLIKIM	17L BES3	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
$3.71 \pm 0.05 \pm 0.15$	6.5k	¹	DOBBS	17	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
$3.39 \pm 0.20 \pm 0.32$	337		ABLIKIM	07C BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
$6.4 \pm 1.8 \pm 0.1$		²	AUBERT	07BD BABR	$10.6 e^+e^- \rightarrow \Lambda\bar{\Lambda}\gamma$
$3.28 \pm 0.23 \pm 0.25$	208		PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.75 \pm 0.09 \pm 0.23$	1.9k	^{1,3}	DOBBS	14	$e^+e^- \rightarrow \Lambda\bar{\Lambda}$
$1.81 \pm 0.20 \pm 0.27$	80	⁴	BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 4	90		FELDMAN	77 MRK1	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{30}/Γ

NODE=M071R28
 NODE=M071R28

¹ Using CLEO-c data but not authored by the CLEO Collaboration.

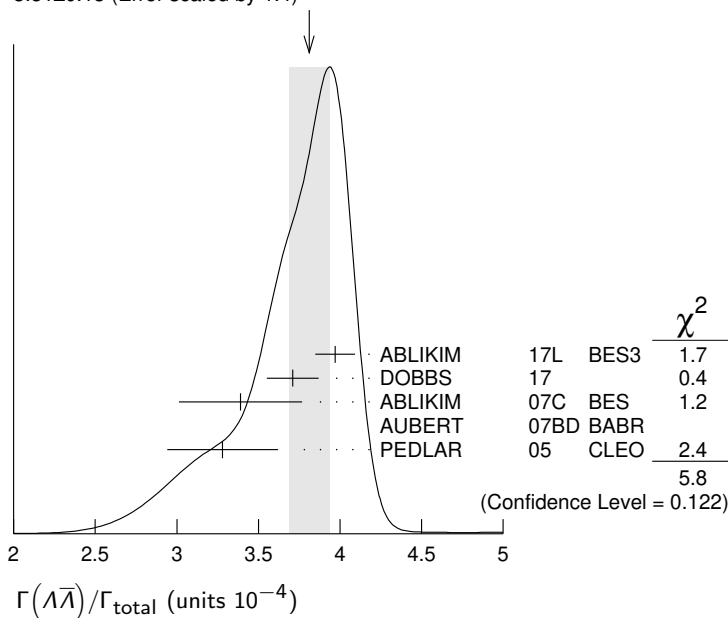
² AUBERT 07BD reports $[\Gamma(\psi(2S) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (15 \pm 4 \pm 1) \times 10^{-4}$ keV which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+e^-) = 2.33 \pm 0.04$ keV. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by DOBBS 17.⁴ Estimated using $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.310 \pm 0.028$.

NODE=M071R28;LINKAGE=A
 NODE=M071R28;LINKAGE=AU

NODE=M071R28;LINKAGE=B
 NODE=M071R28;LINKAGE=PP

WEIGHTED AVERAGE
 3.81 ± 0.13 (Error scaled by 1.4)

 $\Gamma(\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.40 \pm 0.03 \pm 0.13$	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow \text{hadrons}$

 Γ_{31}/Γ

NODE=M071S65
 NODE=M071S65

 $\Gamma(\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.54 \pm 0.04 \pm 0.13$	2.8k	ABLIKIM	13W BES3	$\psi(2S) \rightarrow \text{hadrons}$

 Γ_{32}/Γ

NODE=M071S66
 NODE=M071S66

 $\Gamma(\Lambda\bar{\Sigma}^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	COMMENT
$1.23 \pm 0.23 \pm 0.08$	30	¹ DOBBS 17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

 Γ_{33}/Γ

NODE=M071P08
 NODE=M071P08

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_{34}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.67±0.13±0.12	276	¹ ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$

¹ Using $B(\Lambda \rightarrow p \pi^-) = 63.9\%$, and $B(\Sigma^0 \rightarrow \Lambda \gamma) = 100\%$.

NODE=M071S63
NODE=M071S63

NODE=M071S63;LINKAGE=AB

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.32±0.12 OUR AVERAGE				

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
NODE=M071R47

NODE=M071R47;LINKAGE=A
NODE=M071R47;LINKAGE=B

 $\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$
 Γ_{36}/Γ

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=M071R51

NODE=M071R51;LINKAGE=A
NODE=M071R51;LINKAGE=B
NODE=M071R51;LINKAGE=PP

 $\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$
 Γ_{37}/Γ

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

 $\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$
 Γ_{38}/Γ

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

 $\Gamma(\Sigma(1385)^0 \bar{\Sigma}(1385)^0)/\Gamma_{\text{total}}$
 Γ_{39}/Γ

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

 $\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$
 Γ_{40}/Γ

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=M071R29

NODE=M071R29;LINKAGE=A
NODE=M071R29;LINKAGE=B
NODE=M071R29;LINKAGE=PP

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.3 ± 0.4 OUR AVERAGE		Error includes scale factor of 4.2.		
2.73 ± 0.03 ± 0.13	11k	ABLIKIM	17E BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
1.97 ± 0.06 ± 0.11	1.2k	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
2.75 ± 0.64 ± 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 ± 0.19 ± 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=M071R48 $\Gamma(\Xi(1530)^0 \Xi(1530)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
5.2 ± 0.3 ^{+3.2}_{-1.2}		527	¹ ABLIKIM	13s BES3	$\psi(2S) \rightarrow \eta p \bar{p}$
• • • 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		² BAI	01 BES	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

¹ With $N(1535)$ decaying to $p\eta$.² Estimated using $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.310 \pm 0.028$.NODE=M071R53
NODE=M071R53NODE=M071R53;LINKAGE=A
NODE=M071R53;LINKAGE=PP $\Gamma(\Xi(1530)^- \Xi(1530)^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
11.45 ± 0.40 ± 0.59	5k	ABLIKIM	19AT BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P26
NODE=M071P26 $\Gamma(\Xi(1530)^- \Xi^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0 ± 1.1 ± 0.4	399	ABLIKIM	19AT BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$

NODE=M071P27
NODE=M071P27 $\Gamma(K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.86 ± 0.27 ± 0.32	236	ABLIKIM	15I BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S82
NODE=M071S82 $\Gamma(\Xi(1690)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
5.21 ± 1.48 ± 0.57	74	ABLIKIM	15I BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S83
NODE=M071S83 $\Gamma(\Xi(1820)^- \Xi^+ \rightarrow K^- \Lambda \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
12.03 ± 2.94 ± 1.22	136	ABLIKIM	15I BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow K^- \Lambda \Xi^+ + \text{c.c.}$

NODE=M071S84
NODE=M071S84 $\Gamma(K^- \Sigma^0 \Xi^+ + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.67 ± 0.33 ± 0.28	142	ABLIKIM	15I BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow K^- \Sigma^0 \Xi^+ + \text{c.c.}$

NODE=M071S85
NODE=M071S85 $\Gamma(\Omega^- \bar{\Omega}^+)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.52 ± 0.03 ± 0.03		326	¹ DOBBS	17	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.47 ± 0.09 ± 0.05		27	^{1,2} DOBBS	14	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 1.5	90		ABLIKIM	12Q BES2	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 1.6	90		PEDLAR	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadrons}$
< 0.73	90		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=M071R54
NODE=M071R54NODE=M071R54;LINKAGE=A
NODE=M071R54;LINKAGE=B
NODE=M071R54;LINKAGE=PP

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

DOCUMENT ID

TECN

COMMENT

 Γ_{50}/Γ NODE=M071R35
NODE=M071R35**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;LINKAGE=AB

 $\Gamma(N(940) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{51}/Γ NODE=M071S56
NODE=M071S56**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;LINKAGE=AB

 $\Gamma(N(1440) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{52}/Γ NODE=M071S50
NODE=M071S50**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.

NODE=M071S50;LINKAGE=AB

² From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances.

NODE=M071S50;LINKAGE=AL

 $\Gamma(N(1520) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{53}/Γ NODE=M071S57
NODE=M071S57**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;LINKAGE=AB

 $\Gamma(N(1535) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{54}/Γ NODE=M071S58
NODE=M071S58**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;LINKAGE=AB

 $\Gamma(N(1650) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{55}/Γ NODE=M071S59
NODE=M071S59**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;LINKAGE=AB

 $\Gamma(N(1720) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{56}/Γ NODE=M071S60
NODE=M071S60**1.79±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;LINKAGE=AB

 $\Gamma(N(2300) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{57}/Γ NODE=M071S61
NODE=M071S61**2.62±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;LINKAGE=AB

 $\Gamma(N(2570) \bar{p} + \text{c.c.} \rightarrow \pi^0 p \bar{p})/\Gamma_{\text{total}}$ VALUE (units 10^{-5})

EVTS

DOCUMENT ID

TECN

COMMENT

 Γ_{58}/Γ NODE=M071S62
NODE=M071S62**2.13±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;LINKAGE=AB

$\Gamma(\pi^0 f_0(2100) \rightarrow \pi^0 p \bar{p}) / \Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1$\pm$0.4$\pm$0.1	76	¹ ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \pi^0 p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \pi^0$ mass distributions to a combination of $N_1^*(1440) \bar{p}$, $\pi^0 f_0(2100)$, and two other broad, unestablished resonances.

NODE=M071S51
NODE=M071S51

NODE=M071S51;LINKAGE=AL

 $\Gamma(\eta p \bar{p}) / \Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0$\pm$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 $\pm$ 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

 $\Gamma(\eta f_0(2100) \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2$\pm$0.4$\pm$0.1	31	¹ ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

NODE=M071S52
NODE=M071S52

NODE=M071S52;LINKAGE=AL

 $\Gamma(N(1535) \bar{p} \rightarrow \eta p \bar{p}) / \Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
4.4$\pm$0.6$\pm$0.3	123	¹ ALEXANDER 10	CLEO	$\psi(2S) \rightarrow \eta p \bar{p}$

¹ From a fit of the $p \bar{p}$ and $p \eta$ distributions to a combination of $N^*(1535) \bar{p}$ and $\eta f_0(2100)$.

NODE=M071S53
NODE=M071S53

NODE=M071S53;LINKAGE=AL

 $\Gamma(\omega p \bar{p}) / \Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.69$\pm$0.21 OUR AVERAGE				
0.6 $\pm$ 0.2 $\pm$ 0.2	21.2	BRIERE 05	CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^- \pi^0$
0.8 $\pm$ 0.3 $\pm$ 0.1	14.9 $\pm$ 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

 $\Gamma(\eta' p \bar{p}) / \Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.10$\pm$0.10$\pm$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

 $\Gamma(\phi p \bar{p}) / \Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
6.06$\pm$0.38$\pm$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

 $\Gamma(\phi X(1835) \rightarrow \phi p \bar{p}) / \Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.82 $\times 10^{-7}$	90	ABLIKIM 19AO	BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} K^+ K^-$

NODE=M071P21
NODE=M071P21

 $\Gamma(\pi^+ \pi^- p \bar{p}) / \Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.0$\pm$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 $\pm$ 2		¹ TANENBAUM 78	MRK1	$e^+ e^-$

¹ Assuming entirely strong decay.

NODE=M071R31
NODE=M071R31

NODE=M071R;LINKAGE=K

$\Gamma(p\bar{n}\pi^- \text{ or c.c.})/\Gamma_{\text{total}}$ Γ_{68}/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_{69}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

3.18±0.50±0.50

135 ± 21

ABLIKIM

06I

BES2

 $e^+e^- \rightarrow p\pi^-\pi^0 X$ NODE=M071R02
NODE=M071R02 $\Gamma(\eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{71}/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_{72}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

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

 $e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow \gamma\gamma)$

OCCUR=2

8.1±1.4±1.6

50.0

2

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow \eta 3\pi(\eta \rightarrow 3\pi)$

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 $\Gamma(2(\pi^+\pi^-)\eta)/\Gamma_{\text{total}}$ Γ_{73}/Γ VALUE (units 10^{-3}) EVTS

DOCUMENT ID

TECN

COMMENT

1.2±0.6±0.1

16

1

AUBERT

07AU

BABR

10.6 $e^+e^- \rightarrow 2(\pi^+\pi^-)\eta\gamma$ 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=M071S38
NODE=M071S38

NODE=M071S38;LINKAGE=UB

 $\Gamma(\eta'\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{75}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

4.5±1.6±1.3

12.8

BRIERE

05

CLEO

 $e^+e^- \rightarrow \psi(2S) \rightarrow \text{hadr}$ NODE=M071S08
NODE=M071S08 $\Gamma(\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{76}/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

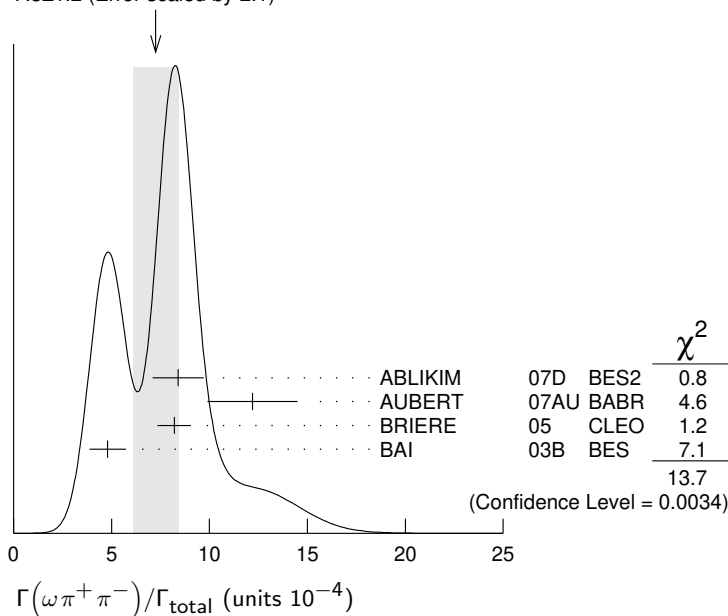
BES

 $\psi(2S) \rightarrow 2(\pi^+\pi^-)\pi^0$ ¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow \omega\pi^+\pi^-) \cdot B(\omega \rightarrow 3\pi) = 2.69 \pm 0.73 \pm 0.16 \text{ eV}$.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)



$\Gamma(b_1^\pm \pi^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.1.		
$5.1 \pm 0.6 \pm 0.8$	202	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
$4.18^{+0.43}_{-0.42} \pm 0.92$	170	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$
$3.2 \pm 0.6 \pm 0.5$	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. • • •				
$5.2 \pm 0.8 \pm 1.0$		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

$\Gamma(b_1^0 \pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.35^{+0.47}_{-0.42} \pm 0.40$	45	ADAM	05 CLEO	$e^+ e^- \rightarrow \psi(2S)$

Γ_{78}/Γ

NODE=M071R21
 NODE=M071R21

$\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 ± 0.4 OUR AVERAGE					
$2.3 \pm 0.5 \pm 0.4$		57	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$
$2.05 \pm 0.41 \pm 0.38$		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

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.3 ± 0.5 OUR AVERAGE				
$8.1 \pm 1.3 \pm 0.3$	133	LEES	12F BABR	$10.6 e^+ e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$
$7.1 \pm 0.3 \pm 0.4$	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. • • •				
$11.0 \pm 1.9 \pm 0.2$	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 $[\Gamma(\psi(2S) \rightarrow \pi^+ \pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (2.56 \pm 0.42 \pm 0.16) \times 10^{-3}$ 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.

Γ_{82}/Γ

NODE=M071R24
 NODE=M071R24

NODE=M071R24;LINKAGE=K
 NODE=M071R24;LINKAGE=B3

$\Gamma(\rho^0 K^+ K^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.2±0.4	223.8	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^-$

 Γ_{84}/Γ NODE=M071S09
NODE=M071S09 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.86±0.32±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		$e^+ e^-$

 Γ_{85}/Γ NODE=M071R66
NODE=M071R66 $\Gamma(K^+ K^- \pi^+ \pi^- \eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.7±0.1	7	¹ AUBERT	07AU BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \eta \gamma$
¹ AUBERT 07AU quotes $\Gamma_{ee}^{\psi(2S)} \cdot B(\psi(2S) \rightarrow 2(\pi^+ \pi^-) \eta) \cdot B(\eta \rightarrow \gamma \gamma) = 1.2 \pm 0.7 \pm 0.1 \text{ eV}$.				

 Γ_{86}/Γ NODE=M071S39
NODE=M071S39

NODE=M071S39;LINKAGE=UB

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.0±2.5±1.8	65	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

 Γ_{87}/Γ NODE=M071R09
NODE=M071R09 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
10.0±1.8±2.1	¹ BAI	99C BES	$e^+ e^-$
¹ Assuming $B(K_1(1270) \rightarrow K \rho) = 0.42 \pm 0.06$			

 Γ_{89}/Γ NODE=M071R41
NODE=M071R41

NODE=M071R;LINKAGE=M2

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.20±0.25±0.37	83 ± 9	ABLIKIM	050 BES2	$e^+ e^- \rightarrow \psi(2S)$

 Γ_{90}/Γ NODE=M071R49
NODE=M071R49 $\Gamma(\rho^0 p \bar{p})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.5±0.1±0.2	61.1	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow p \bar{p} \pi^+ \pi^-$

 Γ_{91}/Γ NODE=M071S14
NODE=M071S14 $\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
6.7±2.5	TANENBAUM 78	MRK1	$e^+ e^-$

 Γ_{92}/Γ NODE=M071R34
NODE=M071R34 $\Gamma(2(\pi^+ \pi^-))/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.4±0.6 OUR AVERAGE	Error includes scale factor of 2.2.			
2.2±0.2±0.2	308	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-)$
4.5±1.0		TANENBAUM 78	MRK1	$e^+ e^-$

 Γ_{93}/Γ NODE=M071R27
NODE=M071R27 $\Gamma(\rho^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.6 OUR AVERAGE	Error includes scale factor of 1.4.			
2.0±0.2±0.4	285.5	BRIERE	05 CLEO	$e^+ e^- \rightarrow \psi(2S) \rightarrow 2(\pi^+ \pi^-)$
4.2±1.5		TANENBAUM 78	MRK1	$e^+ e^-$

 Γ_{94}/Γ NODE=M071R33
NODE=M071R33 $\Gamma(K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$

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	$e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

 Γ_{95}/Γ NODE=M071S10
NODE=M071S10

¹ AUBERT 07AU reports $[\Gamma(\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+ e^-)] = (44 \pm 13 \pm 3) \times 10^{-4} \text{ keV}$ which we divide by our best value $\Gamma(\psi(2S) \rightarrow e^+ e^-) = 2.33 \pm 0.04 \text{ keV}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071S10;LINKAGE=UB

$\Gamma(\omega f_0(1710) \rightarrow \omega K^+ K^-) / \Gamma_{\text{total}}$
 Γ_{96}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.9 \pm 2.0 \pm 0.9$	19	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S20
NODE=M071S20

 $\Gamma(K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}) / \Gamma_{\text{total}}$
 Γ_{97}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$8.6 \pm 1.3 \pm 1.8$	238	ABLIKIM	06G	BES2 $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S21
NODE=M071S21

 $\Gamma(K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}) / \Gamma_{\text{total}}$
 Γ_{98}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$9.6 \pm 2.2 \pm 1.7$	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_{99}/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_{100}/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

 $\Gamma(\eta K^+ K^-, \text{ no } \eta\phi) / \Gamma_{\text{total}}$
 Γ_{101}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
3.49 ± 0.17 OUR AVERAGE			[(3.1 ± 0.4) $\times 10^{-5}$ OUR 2020 AVERAGE]		
$3.49 \pm 0.09 \pm 0.15$	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 $e^+ e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071S11
NODE=M071S11

NEW

¹ Excluding $\eta\phi$.

² Superseded by ABLIKIM 20F.

NODE=M071S11;LINKAGE=AB
NODE=M071S11;LINKAGE=A

 $\Gamma(\omega K^+ K^-) / \Gamma_{\text{total}}$
 Γ_{102}/Γ

<i>VALUE</i> (units 10^{-4})	<i>EVTS</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
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 $e^+e^- \rightarrow \psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$
1.5 ±0.3 ±0.2	23	¹ BAI	03B	BES $\psi(2S) \rightarrow K^+ K^- \pi^+ \pi^- \pi^0$

NODE=M071R78
NODE=M071R78

¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.

NODE=M071R78;LINKAGE=B3

 $\Gamma(\omega K^*(892)^+ K^- + \text{c.c.}) / \Gamma_{\text{total}}$
 Γ_{103}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
20.7 ± 2.6 OUR AVERAGE				
$18.9 \pm 2.9 \pm 2.2$	396	ABLIKIM	13M	BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$
$22.6 \pm 3.0 \pm 2.4$	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 AVERAGE				
$6.39 \pm 1.50 \pm 0.78$	128	ABLIKIM	13M	BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$
$5.86 \pm 1.61 \pm 0.83$	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
$16.8 \pm 2.5 \pm 1.6$	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
$5.82 \pm 2.08 \pm 0.72$	116	ABLIKIM	13M	BES3 $\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

NODE=M071S70
NODE=M071S70

$$\Gamma(\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{107}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.60±0.27±0.24	109	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S71
NODE=M071S71

NODE=M071S71;LINKAGE=AB

$$\Gamma(\omega X(1440) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{108}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.09±0.20±0.16	82	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

¹ X(1440) compatible with $\eta(1405)$ and $\eta(1475)$. A $f_1(1420)$ is also possible.

NODE=M071S72
NODE=M071S72

NODE=M071S72;LINKAGE=AB

$$\Gamma(\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{109}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.302±0.098±0.027	22	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K_S^0 K^- \pi^+$

¹ Statistical significance 4.5 σ . This measurement is equivalent to a limit of $< 0.478 \times 10^{-5}$ at 90% C.L.

NODE=M071S73
NODE=M071S73

NODE=M071S73;LINKAGE=AB

$$\Gamma(\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{110}/\Gamma$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
0.125±0.070±0.013	10	¹ ABLIKIM	13M BES3	$\psi(2S) \rightarrow \omega K^+ K^- \pi^0$

¹ Statistical significance 3.2 σ . This measurement is equivalent to a limit of $< 0.221 \times 10^{-5}$ at 90% C.L.

NODE=M071S74
NODE=M071S74

NODE=M071S74;LINKAGE=AB

$$\Gamma(3(\pi^+ \pi^-))/\Gamma_{\text{total}} \quad \Gamma_{111}/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.5 ±2.0 OUR AVERAGE	Error includes scale factor of 2.8.			
5.45±0.42±0.87	671	ABLIKIM	05H BES2	$e^+ e^- \rightarrow \psi(2S) \rightarrow 3(\pi^+ \pi^-)$

1.5 ±1.0

¹ TANENBAUM 78 MRK1 $e^+ e^-$

¹ Assuming entirely strong decay.

NODE=M071R32
NODE=M071R32

NODE=M071R32;LINKAGE=K

$$\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{112}/\Gamma$$

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

$$\Gamma(K^+ K^-)/\Gamma_{\text{total}} \quad \Gamma_{113}/\Gamma$$

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
7.48±0.23±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 ±1.5 ±0.2	66	2,3 LEES	15J BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
8.3 ±1.5 ±0.2	66	3,4 LEES	15J BABR	$e^+ e^- \rightarrow K^+ K^- \gamma$
6.3 ±0.6 ±0.3		⁵ DOBBS	06A CLEO	$e^+ e^-$
10 ±7		⁵ BRANDELIK	79C DASP	$e^+ e^-$
< 5	90	FELDMAN	77 MRK1	$e^+ e^-$

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

² $\sin\phi > 0$.

³ Using $\Gamma(\psi(2S) \rightarrow e^+ e^-) = (2.37 \pm 0.04) \text{ keV}$.

⁴ $\sin\phi < 0$.

⁵ Interference with non-resonant $K^+ K^-$ production not taken into account.

NODE=M071R23
NODE=M071R23

OCCUR=2

NODE=M071R23;LINKAGE=ME
NODE=M071R23;LINKAGE=A
NODE=M071R23;LINKAGE=B
NODE=M071R23;LINKAGE=C
NODE=M071R23;LINKAGE=BA

$$\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}} \quad \Gamma_{114}/\Gamma$$

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

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{115}/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.

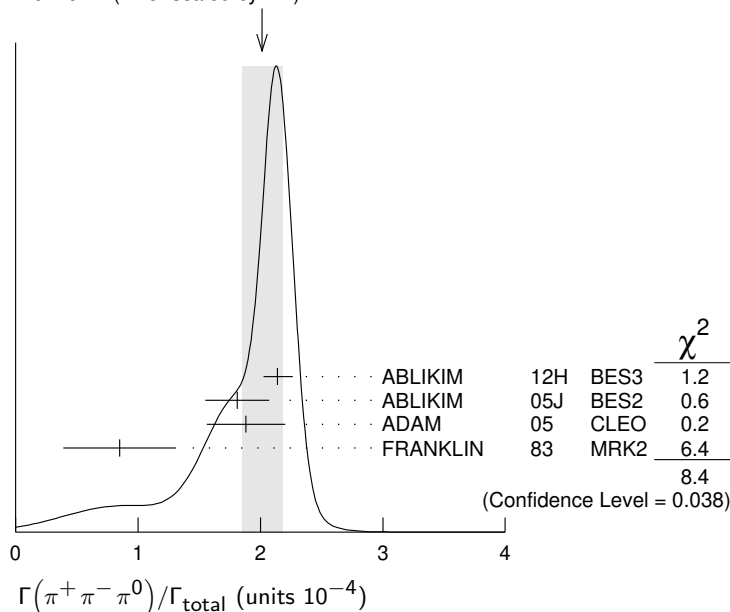
² From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R36
NODE=M071R36

NODE=M071R36;LINKAGE=AB

NODE=M071R;LINKAGE=AK

WEIGHTED AVERAGE
 2.01 ± 0.17 (Error scaled by 1.7)

 $\Gamma(\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.94 \pm 0.25^{+1.15}_{-0.34}$	¹ ABLIKIM	05J BES2	$\psi(2S) \rightarrow \rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$

¹ From a PW analysis of $\psi(2S) \rightarrow \pi^+\pi^-\pi^0$.

NODE=M071R57
NODE=M071R57

NODE=M071R57;LINKAGE=AK

 $\Gamma(\rho(770)\pi \rightarrow \pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{117}/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	$e^+e^- \rightarrow \psi(2S)$

• • • 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
NODE=M071R26

NODE=M071R26;LINKAGE=AK
NODE=M071R;LINKAGE=N

 $\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{118}/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

$\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	¹ BAI	99C BES	e^+e^-

¹ Assuming $B(K_1(1400) \rightarrow K^* \pi) = 0.94 \pm 0.06$ NODE=M071R45
NODE=M071R45

NODE=M071R;LINKAGE=M3

 $\Gamma(K_2^*(1430)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{120}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.12 \pm 0.62^{+1.13}_{-0.61}$	251 ± 22	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071S54
NODE=M071S54 $\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{121}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.07 \pm 0.16 \pm 0.26$	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 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{124}/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 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{125}/Γ

VALUE (units 10^{-5})	CL%	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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R30
NODE=M071R30 $\Gamma(K^+ K^*(892)^- + \text{c.c.})/\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})$ $\Gamma_{124}/\Gamma_{125}$

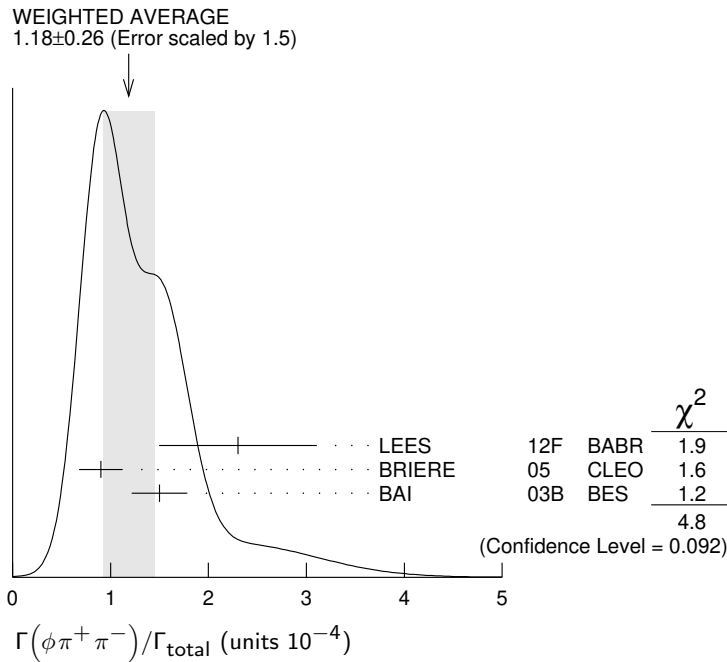
VALUE	DOCUMENT ID	TECN	COMMENT
0.16 ± 0.06 OUR AVERAGE			
$0.22^{+0.10}_{-0.14}$	ABLIKIM	05I BES2	$e^+e^- \rightarrow \psi(2S)$
$0.14^{+0.08}_{-0.06}$	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R46
NODE=M071R46 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{126}/Γ

VALUE (units 10^{-4})	CL%	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	$10.6 e^+e^- \rightarrow \pi^+ \pi^- K^+ K^- \gamma$

NODE=M071R80
NODE=M071R80¹ Normalized to $B(\psi(2S) \rightarrow J/\psi \pi^+ \pi^-) = 0.305 \pm 0.016$.² Superseded by LEES 12F. AUBERT 07AK reports $[\Gamma(\psi(2S) \rightarrow \phi \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [\Gamma(\psi(2S) \rightarrow e^+e^-)] = (0.57 \pm 0.22 \pm 0.04) \times 10^{-3}$ 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.³ Using $B(\phi \rightarrow K^+ K^-) = (49.3 \pm 0.6)\%$.NODE=M071R80;LINKAGE=B3
NODE=M071R80;LINKAGE=BE

NODE=M071R80;LINKAGE=UB



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

Γ_{127}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.75±0.33 OUR AVERAGE		Error includes scale factor of 1.6.		
1.5 ±0.5 ±0.1	12 ± 4	LEES	12F BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$
0.6 ±0.2 ±0.1	18.4 ± 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±0.71±0.02	6 ± 3	^{2,3} AUBERT	07AK BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

¹Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

²Superseded 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.

³Using $B(\phi \rightarrow K^+K^-) = (49.3 \pm 0.6)\%$.

NODE=M071R83
NODE=M071R83

NODE=M071R83;LINKAGE=B3
NODE=M071R83;LINKAGE=BE

NODE=M071R83;LINKAGE=UB

$\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$

Γ_{128}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.63±0.13 OUR AVERAGE				
0.9 ±0.4 ±0.1	13	LEES	12F BABR	10.6 $e^+e^- \rightarrow 2(K^+K^-)\gamma$
0.6 ±0.1 ±0.1	59.2	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$

NODE=M071S12
NODE=M071S12

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

Γ_{129}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
0.70±0.16 OUR AVERAGE				
0.8 ±0.2 ±0.1	36.8	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)$
0.6 ±0.2 ±0.1	16.1 ± 5.0	¹ BAI	03B BES	$\psi(2S) \rightarrow 2(K^+K^-)$

NODE=M071R81
NODE=M071R81

¹Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$.

NODE=M071R81;LINKAGE=B3

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

Γ_{130}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.2±0.2	44.7	BRIERE	05 CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow 2(K^+K^-)\pi^0$

NODE=M071S13
NODE=M071S13

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

Γ_{131}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.10±0.31 OUR AVERAGE				
3.14±0.23±0.23	0.2k	ABLIKIM	12L BES3	$e^+e^- \rightarrow \psi(2S)$
2.0 ^{+1.5} _{-1.1} ±0.4	6	ADAM	05 CLEO	$e^+e^- \rightarrow \psi(2S)$
3.3 ±1.1 ±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_{132}/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_{133}/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=M071R90

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R;LINKAGE=AI

 $\Gamma(\omega\eta')/\Gamma_{\text{total}}$
 Γ_{136}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.2$^{+2.4}_{-2.0}$ $\pm$0.7	4	¹ ABLIKIM 04K	BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R91
NODE=M071R91

¹ Calculated combining $\eta' \rightarrow \gamma\rho$ and $\eta\pi^+\pi^-$ channels.

NODE=M071R91;LINKAGE=AI

 $\Gamma(\omega\pi^0)/\Gamma_{\text{total}}$
 Γ_{137}/Γ

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

 $\Gamma(\rho\eta')/\Gamma_{\text{total}}$
 Γ_{138}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.87 $^{+1.64}_{-1.11}$ $\pm$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 $\pm$ 0.11 $\pm$ 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

¹ Destructive-interference solution of a partial wave analysis of the decay $\psi(2S) \rightarrow \pi^+\pi^-\eta'$.

OCCUR=2

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

 $\Gamma(\rho\eta)/\Gamma_{\text{total}}$
 Γ_{139}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2 $\pm$0.6 OUR AVERAGE				Error includes scale factor of 1.1.
3.0 $^{+1.1}_{-0.9}$ $\pm$ 0.2	18	ADAM 05	CLEO	$e^+e^- \rightarrow \psi(2S)$
1.78 $^{+0.67}_{-0.62}$ $\pm$ 0.17	13	ABLIKIM 04L	BES	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R94
NODE=M071R94

 $\Gamma(\omega\eta)/\Gamma_{\text{total}}$
 Γ_{140}/Γ

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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R95
NODE=M071R95

 $\Gamma(\phi\pi^0)/\Gamma_{\text{total}}$
 Γ_{141}/Γ

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	$e^+e^- \rightarrow \psi(2S)$

NODE=M071R96
NODE=M071R96

 $\Gamma(\eta_c\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$
 Γ_{142}/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

 $\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$
 Γ_{143}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.7$\pm$0.6$\pm$0.4	30.1	BRIERE 05	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow p\bar{p}K^+K^-$

NODE=M071S16
NODE=M071S16

$\Gamma(\bar{\Lambda}nK_S^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{144}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.81 \pm 0.11 \pm 0.14$	50	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=M071R08
NODE=M071R08

NODE=M071R08;LINKAGE=AB

 $\Gamma(\phi f_2'(1525))/\Gamma_{\text{total}}$ Γ_{145}/Γ

VALUE (units 10^{-4})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$0.44 \pm 0.12 \pm 0.11$	20 ± 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

 $\Gamma(\phi f_1(1285))/\Gamma_{\text{total}}$ Γ_{134}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$3.0 \pm 0.4 \pm 1.3$	234	¹ ABLIKIM	19BA BES3	$e^+e^- \rightarrow \psi(2S)$

¹ 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
NODE=M071P22

NODE=M071P22;LINKAGE=B

 $\Gamma(\phi\eta(1405) \rightarrow \phi\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{135}/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

 $\Gamma(\Theta(1540)\bar{\Theta}(1540) \rightarrow K_S^0 p K^- \bar{n} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{146}/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_{147}/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_{148}/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_{149}/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_{150}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.60	90	BAI	04G BES2	e^+e^-

NODE=M071S05
NODE=M071S05

 $\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{151}/Γ

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

 $\Gamma(\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{152}/Γ

VALUE	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
$<1.7 \times 10^{-6}$	90	450M	ABLIKIM	18Q BES3	$e^+e^- \rightarrow \psi(2S)$

NODE=M071P11
NODE=M071P11

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{153}/Γ

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

9.79 ± 0.20 OUR 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.

NODE=M071315

NODE=M071R55
NODE=M071R55

NODE=M071R;LINKAGE=A

$\Gamma(\gamma\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{154}/Γ VALUE (units 10^{-2}) EVTS

DOCUMENT ID

TECN

COMMENT

9.75 $\pm$ 0.24 OUR FIT**9.54 $\pm$ 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 $\pm$ 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.NODE=M071R58
NODE=M071R58NODE=M071R;LINKAGE=G
NODE=M071R;LINKAGE=B $\Gamma(\gamma\chi_{c2}(1P))/\Gamma_{\text{total}}$ Γ_{155}/Γ VALUE (units 10^{-2}) EVTS

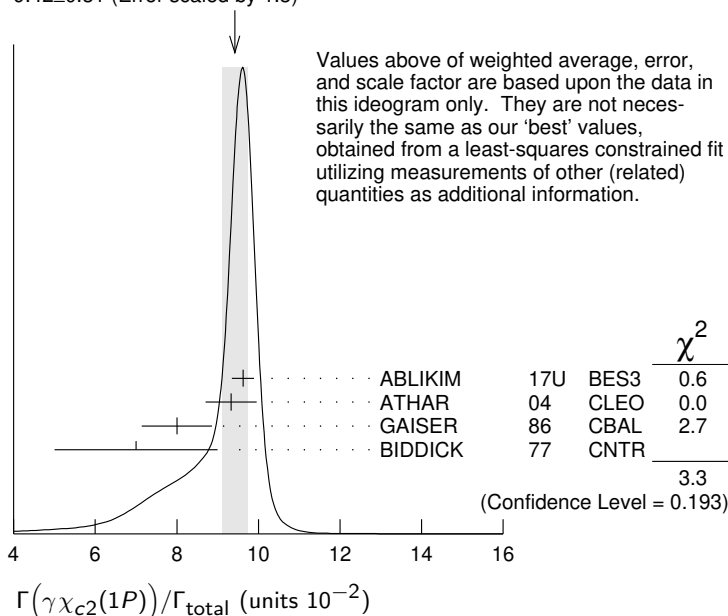
DOCUMENT ID

TECN

COMMENT

9.52 $\pm$ 0.20 OUR FIT**9.42 $\pm$ 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 $\pm$ 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.NODE=M071R59
NODE=M071R59NODE=M071R;LINKAGE=F
NODE=M071R59;LINKAGE=BWEIGHTED AVERAGE
9.42 $\pm$ 0.31 (Error scaled by 1.3) $[\Gamma(\gamma\chi_{c0}(1P)) + \Gamma(\gamma\chi_{c1}(1P)) + \Gamma(\gamma\chi_{c2}(1P))]/\Gamma_{\text{total}}$ ($\Gamma_{153} + \Gamma_{154} + \Gamma_{155})/\Gamma$

VALUE DOCUMENT ID TECN COMMENT

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

27.6 $\pm$ 0.3 $\pm$ 2.0 ¹ ATHAR 04 CLEO $e^+e^- \rightarrow \gamma X$ ¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R19
NODE=M071R19

NODE=M071R;LINKAGE=AH

 $\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{153}/\Gamma_{154}$

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 $B(\gamma\chi_{cJ})$.NODE=M071R97
NODE=M071R97

NODE=M071R97;LINKAGE=AH

 $\Gamma(\gamma\chi_{c2}(1P))/\Gamma(\gamma\chi_{c1}(1P))$ $\Gamma_{155}/\Gamma_{154}$

VALUE DOCUMENT ID TECN COMMENT

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

1.03 $\pm$ 0.02 $\pm$ 0.03 ¹ ATHAR 04 CLEO $e^+e^- \rightarrow \gamma X$ ¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.NODE=M071R98
NODE=M071R98

NODE=M071R98;LINKAGE=AH

$\Gamma(\gamma\chi_{c0}(1P))/\Gamma(\gamma\chi_{c2}(1P))$ $\Gamma_{153}/\Gamma_{155}$

VALUE	DOCUMENT ID	TECN	COMMENT

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

$0.99 \pm 0.02 \pm 0.08$	¹ ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$

¹ Not independent from ATHAR 04 measurements of $B(\gamma\chi_{cJ})$.

NODE=M071R99
NODE=M071R99

NODE=M071R99;LINKAGE=AH

 $\Gamma(\gamma\eta_c(1S))/\Gamma_{\text{total}}$ Γ_{156}/Γ

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

0.34 $\pm$ 0.05 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.

$0.432 \pm 0.016 \pm 0.060$		MITCHELL	09	CLEO $e^+e^- \rightarrow \gamma X$

$0.32 \pm 0.04 \pm 0.06$	2.5k	¹ ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$

0.28 ± 0.06		² GAISER	86	CBAL $e^+e^- \rightarrow \gamma X$

¹ ATHAR 04 used $\Gamma_{\eta_c(1S)} = 24.8 \pm 4.9$ MeV to obtain this result.

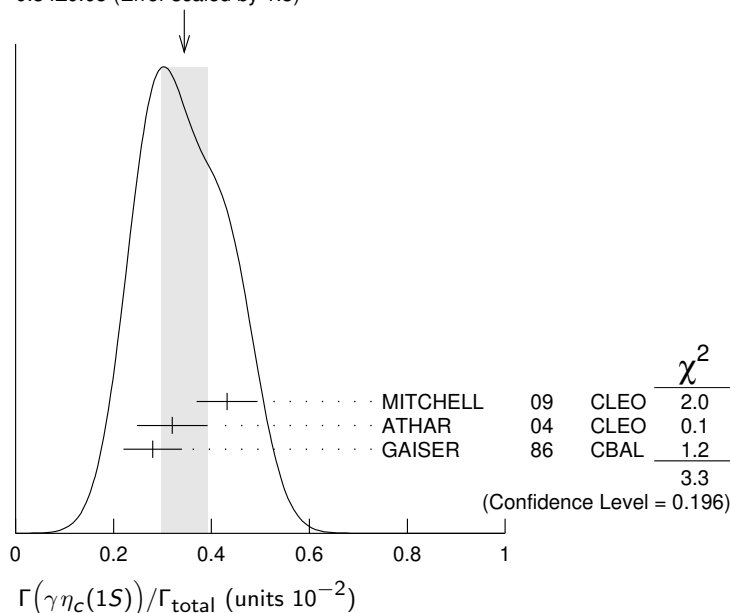
² GAISER 86 used $\Gamma_{\eta_c(1S)} = 11.5 \pm 4.5$ MeV to obtain this result.

NODE=M071R60
NODE=M071R60

NODE=M071R60;LINKAGE=AT

NODE=M071R60;LINKAGE=GA

WEIGHTED AVERAGE
0.34 $\pm$ 0.05 (Error scaled by 1.3)

 $\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{157}/Γ

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

7 $\pm$ 2 $\pm$ 4 ¹ ABLIKIM 12G BES3 $\psi(2S) \rightarrow \gamma K^0 K \pi, K K \pi^0$

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

< 8	90	² CRONIN-HEN..10	CLEO	$\psi(2S) \rightarrow \gamma K \bar{K} \pi$

<20	90	ATHAR	04	CLEO $e^+e^- \rightarrow \gamma X$

20-130	95	EDWARDS	82C	CBAL $e^+e^- \rightarrow \gamma X$

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
NODE=M071R62

NODE=M071R62;LINKAGE=AB

NODE=M071R62;LINKAGE=CR

 $\Gamma(\gamma\pi^0)/\Gamma_{\text{total}}$ Γ_{158}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

1.04 $\pm$ 0.22 OUR AVERAGE Error includes scale factor of 1.4.

$0.95 \pm 0.16 \pm 0.05$	423	ABLIKIM	17X	BES3	$\psi(2S) \rightarrow \gamma\pi^0$

$1.58 \pm 0.40 \pm 0.13$	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	WIIK	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

$\Gamma(\gamma\eta'(958))/\Gamma_{\text{total}}$ VALUE (units 10^{-4}) CL% EVTS**1.24 $\pm$ 0.04 OUR AVERAGE**1.251 $\pm$ 0.022 $\pm$ 0.062 56k

DOCUMENT ID

TECN

COMMENT

ABLIKIM

17X

BES3

 $\psi(2S) \rightarrow \gamma\pi^+\pi^-\eta,$ $\gamma\pi^0\pi^0\eta$ 1.26 $\pm$ 0.03 $\pm$ 0.08

2226

¹ ABLIKIM

10F

BES3

 $\psi(2S) \rightarrow 3\gamma\pi^+\pi^-,$ $2\gamma\pi^+\pi^-$ 1.19 $\pm$ 0.08 $\pm$ 0.03

PEDLAR

09

CLE3

 $\psi(2S) \rightarrow \gamma X$ 1.24 $\pm$ 0.27 $\pm$ 0.15

23

ABLIKIM

06R

BES2

 $e^+e^- \rightarrow \psi(2S)$ 1.54 $\pm$ 0.31 $\pm$ 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=M071R44

 Γ_{159}/Γ $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ 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 $\pm$ 0.15^{+0.03}_{-0.10} 1.9k^{1,2} DOBBS

15

 $\psi(2S) \rightarrow \gamma\pi\pi$ 2.12 $\pm$ 0.19 $\pm$ 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 $\pm$ 0.19 $\pm$ 0.33 200.6 $\pm$ 18.8³ BAI

03C

BES

 $\psi(2S) \rightarrow \gamma\pi^+\pi^-$ 2.90 $\pm$ 1.08 $\pm$ 1.07 29.9 $\pm$ 11.1³ 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 $B(f_2(1270) \rightarrow \pi\pi) = (84.2^{+2.9}_{-0.9}) \times 10^{-2}$. 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=M071R44;LINKAGE=AB

NODE=M071R;LINKAGE=R

NODE=M071R;LINKAGE=C

 Γ_{160}/Γ

NODE=M071R84

NODE=M071R84

 $\Gamma(\gamma f_0(1370) \rightarrow \gamma K\bar{K})/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

COMMENT

3.1 $\pm$ 1.0 $\pm$ 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. Γ_{161}/Γ

NODE=M071S75

NODE=M071S75

 $\Gamma(\gamma f_0(1500))/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

COMMENT

9.3 $\pm$ 1.8 $\pm$ 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. Γ_{162}/Γ

NODE=M071S76

NODE=M071S76

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

COMMENT

3.3 $\pm$ 0.8 $\pm$ 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 $B(f'_2(1525) \rightarrow K\bar{K}) = (87.6 \pm 2.2) \times 10^{-2}$. 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. Γ_{163}/Γ

NODE=M071S77

NODE=M071S77

 $\Gamma(\gamma f_0(1710) \rightarrow \gamma\pi\pi)/\Gamma_{\text{total}}$ VALUE (units 10^{-5}) EVTS

DOCUMENT ID

TECN

COMMENT

3.5 $\pm$ 0.6 OUR AVERAGE3.6 $\pm$ 0.4 $\pm$ 0.5

290

¹ DOBBS

15

BES

 $\psi(2S) \rightarrow \gamma\pi\pi$ 3.01 $\pm$ 0.41 $\pm$ 1.2435.6 $\pm$ 4.8² BAI

03C

BES

 $\psi(2S) \rightarrow \gamma\pi^+\pi^-$ ¹ Using CLEO-c data but not authored by the CLEO Collaboration.² Normalized to $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = 0.305 \pm 0.016$. Γ_{165}/Γ

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_{166}/Γ

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

6.6 $\pm$ 0.7 OUR AVERAGE

6.7 $\pm$ 0.6 $\pm$ 0.6		375	¹ DOBBS	15	$\psi(2S) \rightarrow \gamma K \bar{K}$

6.04 $\pm$ 0.90 $\pm$ 1.32	39.6 $\pm$ 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 $\pm$ 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_{167}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT

4.8 $\pm$ 0.5 $\pm$ 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_{168}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	COMMENT

3.2 $\pm$ 0.6 $\pm$ 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_{169}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT

< 5.8 $\times 10^{-6}$ 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=DO

 $\Gamma(\gamma f_J(2220) \rightarrow \gamma K \bar{K})/\Gamma_{\text{total}}$ Γ_{170}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT

< 9.5 $\times 10^{-6}$ 90 ^{1,2} DOBBS 15 $\psi(2S) \rightarrow \gamma K \bar{K}$

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
NODE=M071S81

NODE=M071S81;LINKAGE=A
NODE=M071S81;LINKAGE=DO

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ Γ_{172}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

0.92 $\pm$ 0.18 OUR AVERAGE

0.85 $\pm$ 0.18 $\pm$ 0.04	382	¹ ABLIKIM	17X BES3		$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$

1.38 $\pm$ 0.48 $\pm$ 0.09	13	¹ ABLIKIM	10F BES3		$\psi(2S) \rightarrow \gamma \pi^+ \pi^- \pi^0$, $\gamma 3\pi^0$

• • • 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
NODE=M071R43

NODE=M071R43;LINKAGE=AB

 $\Gamma(\gamma \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{173}/Γ

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

8.71 $\pm$ 1.25 $\pm$ 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_{175}/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 $\eta(1405) \rightarrow K \bar{K} \pi$.

NODE=M071R61
NODE=M071R61

OCCUR=2

NODE=M071R;LINKAGE=E

$\Gamma(\gamma\eta(1405) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{176}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.36 \pm 0.25 \pm 0.05$	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_{177}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.0 \times 10^{-7}$	90	ABLIKIM	17AJ BES3	$\psi(2S) \rightarrow \gamma\pi^+\pi^-\pi^0$

NODE=M071P09
 NODE=M071P09

 $\Gamma(\gamma\eta(1475) \rightarrow K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_{179}/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

 $\Gamma(\gamma\eta(1475) \rightarrow \eta\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{180}/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

 $\Gamma(\gamma 2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{181}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$39.6 \pm 2.8 \pm 5.0$	583	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071S28
 NODE=M071S28

 $\Gamma(\gamma K^{*0} K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{182}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$37.0 \pm 6.1 \pm 7.2$	237	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071S29
 NODE=M071S29

 $\Gamma(\gamma K^{*0} \bar{K}^{*0})/\Gamma_{\text{total}}$ Γ_{183}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$24.0 \pm 4.5 \pm 5.0$	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_{184}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$25.6 \pm 3.6 \pm 3.6$	115	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071S31
 NODE=M071S31

 $\Gamma(\gamma K^+ K^- \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{185}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$19.1 \pm 2.7 \pm 4.3$	132	ABLIKIM	07D BES2	$e^+e^- \rightarrow \psi(2S)$

NODE=M071S32
 NODE=M071S32

 $\Gamma(\gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{186}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
3.9 ± 0.5 OUR AVERAGE				Error includes scale factor of 2.0.
$4.18 \pm 0.26 \pm 0.18$	348	¹ ALEXANDER	10 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
$2.9 \pm 0.4 \pm 0.4$	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

 $\Gamma(\gamma f_2(1950) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{187}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.2 \pm 0.2 \pm 0.1$	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

 $\Gamma(\gamma f_2(2150) \rightarrow \gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{188}/Γ

VALUE (units 10^{-5})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.72 \pm 0.18 \pm 0.03$	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

$\Gamma(\gamma X(1835) \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{189}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$4.57 \pm 0.36^{+1.77}_{-4.26}$		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	$\psi(2S) \rightarrow \gamma p \bar{p}$

 $\Gamma(\gamma X \rightarrow \gamma p \bar{p})/\Gamma_{\text{total}}$ Γ_{190}/Γ

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

 $\Gamma(\gamma \pi^+ \pi^- p \bar{p})/\Gamma_{\text{total}}$ Γ_{191}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.8 \pm 1.2 \pm 0.7$	17	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S34
 NODE=M071S34

 $\Gamma(\gamma 2(\pi^+ \pi^-) K^+ K^-)/\Gamma_{\text{total}}$ Γ_{192}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<22	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S35
 NODE=M071S35

 $\Gamma(\gamma 3(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{193}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<17	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S36
 NODE=M071S36

 $\Gamma(\gamma K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{194}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<4	90	ABLIKIM	07D BES2	$e^+ e^- \rightarrow \psi(2S)$

NODE=M071S37
 NODE=M071S37

 $\Gamma(\gamma \gamma J/\psi)/\Gamma_{\text{total}}$ Γ_{195}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.1 \pm 0.6^{+0.8}_{-1.0}$	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

 $\Gamma(e^+ e^- \eta')/\Gamma_{\text{total}}$ Γ_{196}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
1.90 ± 0.26 OUR AVERAGE				
$1.99 \pm 0.33 \pm 0.12$	57	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$,
				$\eta' \rightarrow \gamma \pi^+ \pi^-$
$1.79 \pm 0.38 \pm 0.11$	20	ABLIKIM	18Z BES3	$\psi(2S) \rightarrow \eta' e^+ e^-$,
				$\eta' \rightarrow \eta \pi^+ \pi^-$

NODE=M071P12
 NODE=M071P12

OCCUR=2

 $\Gamma(e^+ e^- \chi_{c0}(1P))/\Gamma_{\text{total}}$ Γ_{197}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.6 ± 2.4 ± 0.4	48	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

NODE=M071P01
 NODE=M071P01

¹ ABLIKIM 17I reports $(11.7 \pm 2.5 \pm 1.0) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+ e^- \chi_{c0}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S))]$ 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 $B(\chi_{c0}(1P) \rightarrow \gamma J/\psi(1S)) = (1.40 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P01;LINKAGE=B

 $\Gamma(e^+ e^- \chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_{198}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.5 ± 0.6 ± 0.2	873	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$

NODE=M071P02
 NODE=M071P02

¹ ABLIKIM 17I reports $(8.6 \pm 0.3 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+ e^- \chi_{c1}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))]$ 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 $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (34.3 \pm 1.0) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M071P02;LINKAGE=B

$\Gamma(e^+e^- \chi_{c2}(1P))/\Gamma_{\text{total}}$
 Γ_{199}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$7.0 \pm 0.7 \pm 0.2$	227	¹ ABLIKIM	17I BES3	$\psi(2S) \rightarrow e^+e^- \gamma J/\psi$
¹ ABLIKIM 17I reports $(6.9 \pm 0.5 \pm 0.6) \times 10^{-4}$ from a measurement of $[\Gamma(\psi(2S) \rightarrow e^+e^- \chi_{c2}(1P))/\Gamma_{\text{total}}] \times [B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))]$ 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 $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.0 \pm 0.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

NODE=M071P03
NODE=M071P03

NODE=M071P03;LINKAGE=B

 $\Gamma(e^+e^- \chi_{c0}(1P))/\Gamma(\gamma \chi_{c0}(1P))$
 $\Gamma_{197}/\Gamma_{153}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$9.4 \pm 1.9 \pm 0.6$	48	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=M071P04
NODE=M071P04

NODE=M071P04;LINKAGE=A

 $\Gamma(e^+e^- \chi_{c1}(1P))/\Gamma(\gamma \chi_{c1}(1P))$
 $\Gamma_{198}/\Gamma_{154}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$8.3 \pm 0.3 \pm 0.4$	873	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=M071P05
NODE=M071P05

NODE=M071P05;LINKAGE=A

 $\Gamma(e^+e^- \chi_{c2}(1P))/\Gamma(\gamma \chi_{c2}(1P))$
 $\Gamma_{199}/\Gamma_{155}$

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$6.6 \pm 0.5 \pm 0.4$	227	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=M071P06
NODE=M071P06

NODE=M071P06;LINKAGE=A

WEAK DECAYS

 $\Gamma(D^0 e^+ e^- + \text{c.c.})/\Gamma_{\text{total}}$
 Γ_{200}/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 $K^- \pi^+ \pi^+ \pi^-$.				

NODE=M071330

NODE=M071P07
NODE=M071P07

NODE=M071P07;LINKAGE=A

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma(e^+e^-)$
 Γ_{201}/Γ_6

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 2.0	90	LEES	13I BABR	$B \rightarrow K^{(*)} \psi(2S)$

NODE=M071S64
NODE=M071S64

$\psi(2S)$ CROSS-PARTICLE BRANCHING RATIOS

NODE=M071240

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.

NODE=M071240

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

NODE=M071250

$\psi(2S) \rightarrow \gamma \chi_{cJ}(1P)$ 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	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M071QAR
NODE=M071QAR

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.

NODE=M071QAR;LINKAGE=A
NODE=M071QAR;LINKAGE=AR

$b_2(\chi_{c2})/b_2(\chi_{c1})$ 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.

NODE=M071QBR
NODE=M071QBR

NODE=M071QBR;LINKAGE=A

NODE=M071QBR;LINKAGE=AR

 $\psi(2S)$ REFERENCES

NODE=M071

ABLIKIM	20F	PR D101 032008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60256
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=10
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		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 D65 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			
EDWARDS	82C	PRL 51 963	M.E.B. Franklin <i>et al.</i>	(LBL, SLAC)	REFID=22216
LEMOIGNE	82	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)	REFID=22173
HIMEL	80	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)	REFID=22084
OREGLIA	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)	REFID=22119
SCHARRE	80	PRL 45 959	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)	REFID=22207
ZHOLENTZ	80	PL 97B 329	D.L. Scharre <i>et al.</i>	(SLAC, LBL)	REFID=21329
Also		PL 96B 214	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10320
		SJNP 34 814	A.A. Zholents <i>et al.</i>	(NOVO)	REFID=10321
BRANDELIK	79B	Translated from YAF 34 1471			
BRANDELIK	79C	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22115
BARTEL	78B	ZPHY C1 233	R. Brandelik <i>et al.</i>	(DASP Collab.)	REFID=22114
TANENBAUM	78	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22111
BIDDICK	77	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)	REFID=22112
BRAUNSCH...	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)	REFID=22059
BURMESTER	77	PL 67B 249	W. Braunschweig <i>et al.</i>	(DASP Collab.)	REFID=22197
FELDMAN	77	PL 66B 395	J. Burmester <i>et al.</i>	(DESY, HAMB, SIEG+)	REFID=22198
YAMADA	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)	REFID=22062
BARTEL	76	Hamburg Conf. 69	S. Yamada	(DASP Collab.)	REFID=22064
TANENBAUM	76	PL 64B 483	W. Bartel <i>et al.</i>	(DESY, HEIDP)	REFID=22192
WHITAKER	76	PRL 36 402	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL) IG	REFID=22194
ABRAMS	75	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)	REFID=22151
ABRAMS	75B	Stanford Symp. 25	G.S. Abrams	(LBL)	REFID=22176
BOYARSKI	75C	PRL 34 1181	G.S. Abrams <i>et al.</i>	(LBL, SLAC)	REFID=22177
HILGER	75	Palermo Conf. 54	A.M. Boyarski <i>et al.</i>	(SLAC, LBL)	REFID=22179
LIBERMAN	75	PRL 35 625	E. Hilger <i>et al.</i>	(STAN, PENN)	REFID=22186
LUTH	75	Stanford Symp. 55	A.D. Liberman	(STAN)	REFID=22046
WIJK	75	PRL 35 1124	V. Luth <i>et al.</i>	(SLAC, LBL) JPC	REFID=22188
		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

NODE=M053M

3773.7±0.4 OUR FIT Error includes scale factor of 1.4.**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 $B^+ \rightarrow D^0\bar{D}^0K^+$ 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 $e^+e^- \rightarrow D\bar{D}$, hadrons3772.0±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

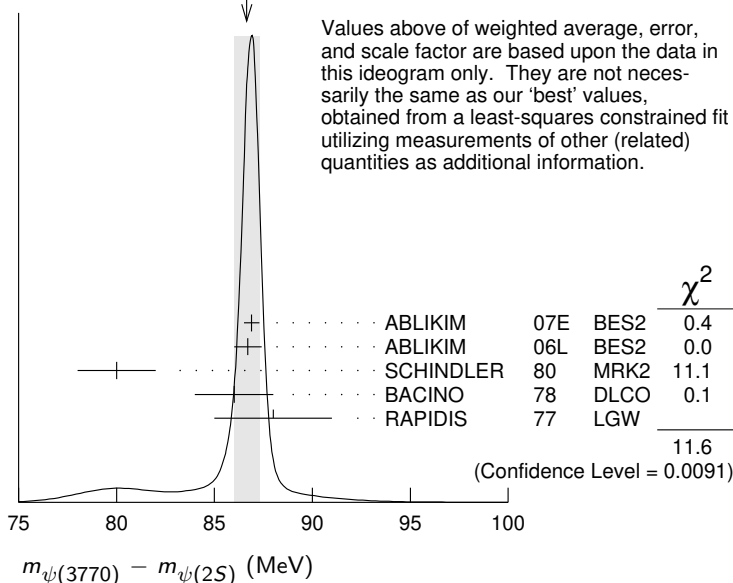
VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

NODE=M053DM

87.6±0.4 OUR FIT Error includes scale factor of 1.4.**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	$e^+e^- \rightarrow D\bar{D}, \text{hadrons}$

NODE=M053W

- Taking into account interference between the resonant and non-resonant $D\bar{D}$ production.
- 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 $\delta = 0^\circ$.
- Interference between the resonant and non-resonant $D\bar{D}$ production not taken into account.
- 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

In addition to the dominant decay mode to $D\bar{D}$, $\psi(3770)$ was found to decay into the final states containing the J/ψ (BAI 05, ADAM 06). ADAMS 06 and HUANG 06A searched for various decay modes with light hadrons and found a statistically significant signal for the decay to $\phi\eta$ only (ADAMS 06).

NODE=M053

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	
Γ_1 $D\bar{D}$	(93 ⁺⁸ ₋₉) %	S=2.0	DESIG=2
Γ_2 $D^0\bar{D}^0$	(52 ⁺⁴ ₋₅) %	S=2.0	DESIG=5
Γ_3 D^+D^-	(41 ± 4) %	S=2.0	DESIG=6
Γ_4 $J/\psi\pi^+\pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		DESIG=4
Γ_5 $J/\psi\pi^0\pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		DESIG=46
Γ_6 $J/\psi\eta$	$(9 \pm 4) \times 10^{-4}$		DESIG=47
Γ_7 $J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	DESIG=48
Γ_8 e^+e^-	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	DESIG=1

Decays to light hadrons

NODE=M053;CLUMP=H

Г ₉	$b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=20
Г ₁₀	$\phi\eta'$	< 7	$\times 10^{-4}$	CL=90%	DESIG=17
Г ₁₁	$\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%	DESIG=16
Г ₁₂	$\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%	DESIG=15
Г ₁₃	$\phi\eta$	(3.1 $\pm$ 0.7)	$\times 10^{-4}$		DESIG=8
Г ₁₄	$\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=14
Г ₁₅	$\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90%	DESIG=13
Г ₁₆	$\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90%	DESIG=12
Г ₁₇	$\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90%	DESIG=11
Г ₁₈	$\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90%	DESIG=9
Г ₁₉	$\rho\pi$	< 5	$\times 10^{-6}$	CL=90%	DESIG=10
Г ₂₀	K^+K^-				DESIG=234
Г ₂₁	$K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90%	DESIG=19
Г ₂₂	$K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=18
Г ₂₃	$K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90%	DESIG=3
Г ₂₄	$2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90%	DESIG=21
Г ₂₅	$2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90%	DESIG=22
Г ₂₆	$2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90%	DESIG=208
Г ₂₇	$\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=24
Г ₂₈	$3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$	CL=90%	DESIG=52
Г ₂₉	$3(\pi^+\pi^-)\pi^0$	< 1.37	%	CL=90%	DESIG=55
Г ₃₀	$3(\pi^+\pi^-)2\pi^0$	< 11.74	%	CL=90%	DESIG=210
Г ₃₁	$\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90%	DESIG=23
Г ₃₂	$\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90%	DESIG=206
Г ₃₃	$\rho^0\pi^+\pi^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=64
Г ₃₄	$\eta 3\pi$	< 1.34	$\times 10^{-3}$	CL=90%	DESIG=25
Г ₃₅	$\eta 2(\pi^+\pi^-)$	< 2.43	%	CL=90%	DESIG=53
Г ₃₆	$\eta\rho^0\pi^+\pi^-$	< 1.45	%	CL=90%	DESIG=221
Г ₃₇	$\eta' 3\pi$	< 2.44	$\times 10^{-3}$	CL=90%	DESIG=26
Г ₃₈	$K^+K^-\pi^+\pi^-$	< 9.0	$\times 10^{-4}$	CL=90%	DESIG=27
Г ₃₉	$\phi\pi^+\pi^-$	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=28
Г ₄₀	$K^+K^-2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90%	DESIG=207
Г ₄₁	$4(\pi^+\pi^-)$	< 1.67	%	CL=90%	DESIG=62
Г ₄₂	$4(\pi^+\pi^-)\pi^0$	< 3.06	%	CL=90%	DESIG=63
Г ₄₃	$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90%	DESIG=29
Г ₄₄	$K^+K^-\pi^+\pi^-\pi^0$	< 2.36	$\times 10^{-3}$	CL=90%	DESIG=30
Г ₄₅	$K^+K^-\rho^0\pi^0$	< 8	$\times 10^{-4}$	CL=90%	DESIG=67
Г ₄₆	$K^+K^-\rho^+\pi^-$	< 1.46	%	CL=90%	DESIG=68
Г ₄₇	ωK^+K^-	< 3.4	$\times 10^{-4}$	CL=90%	DESIG=32
Г ₄₈	$\phi\pi^+\pi^-\pi^0$	< 3.8	$\times 10^{-3}$	CL=90%	DESIG=69
Г ₄₉	$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	< 1.62	%	CL=90%	DESIG=70
Г ₅₀	$K^{*+}K^-\pi^+\pi^- + \text{c.c.}$	< 3.23	%	CL=90%	DESIG=71
Г ₅₁	$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67	%	CL=90%	DESIG=209
Г ₅₂	$K^+K^-2(\pi^+\pi^-)$	< 1.03	%	CL=90%	DESIG=57
Г ₅₃	$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60	%	CL=90%	DESIG=58
Г ₅₄	ηK^+K^-	< 4.1	$\times 10^{-4}$	CL=90%	DESIG=31
Г ₅₅	$\eta K^+K^-\pi^+\pi^-$	< 1.24	%	CL=90%	DESIG=222
Г ₅₆	$\rho^0 K^+K^-$	< 5.0	$\times 10^{-3}$	CL=90%	DESIG=65
Г ₅₇	$2(K^+K^-)$	< 6.0	$\times 10^{-4}$	CL=90%	DESIG=33
Г ₅₈	ϕK^+K^-	< 7.5	$\times 10^{-4}$	CL=90%	DESIG=34
Г ₅₉	$2(K^+K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=35
Г ₆₀	$2(K^+K^-)\pi^+\pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=59
Г ₆₁	$K_S^0 K^-\pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	DESIG=200
Г ₆₂	$K_S^0 K^-\pi^+\pi^0$	< 1.33	%	CL=90%	DESIG=201
Г ₆₃	$K_S^0 K^-\rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	DESIG=214
Г ₆₄	$K_S^0 K^-2\pi^+\pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	DESIG=202
Г ₆₅	$K_S^0 K^-\pi^+\rho^0$	< 1.6	%	CL=90%	DESIG=215

Γ ₆₆	$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	DESIG=216
Γ ₆₇	$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	DESIG=203
Γ ₆₈	$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	DESIG=217
Γ ₆₉	$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	DESIG=204
Γ ₇₀	$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	DESIG=205
Γ ₇₁	$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	DESIG=218
Γ ₇₂	$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	DESIG=219
Γ ₇₃	$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	DESIG=220
Γ ₇₄	$K_S^0 K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	DESIG=60
Γ ₇₅	$p\bar{p}$				DESIG=233
Γ ₇₆	$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=54
Γ ₇₇	$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	DESIG=36
Γ ₇₈	$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	DESIG=42
Γ ₇₉	$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	DESIG=37
Γ ₈₀	$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	DESIG=39
Γ ₈₁	$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	DESIG=72
Γ ₈₂	$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	DESIG=61
Γ ₈₃	$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	DESIG=38
Γ ₈₄	$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	DESIG=223
Γ ₈₅	$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	DESIG=66
Γ ₈₆	$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	DESIG=40
Γ ₈₇	$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	DESIG=224
Γ ₈₈	$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	DESIG=225
Γ ₈₉	$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	DESIG=41
Γ ₉₀	$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	DESIG=43
Γ ₉₁	$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	DESIG=44
Γ ₉₂	$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	DESIG=45
Γ ₉₃	$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	DESIG=226
Γ ₉₄	$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	DESIG=227
Γ ₉₅	$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	DESIG=228
Γ ₉₆	$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=229
Γ ₉₇	$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	DESIG=230

Radiative decays

Γ ₉₈	$\gamma\chi_{c2}$	< 6.4	$\times 10^{-4}$	CL=90%	NODE=M053;CLUMP=R DESIG=51
Γ ₉₉	$\gamma\chi_{c1}$	(2.49 ± 0.23)	$\times 10^{-3}$		DESIG=50
Γ ₁₀₀	$\gamma\chi_{c0}$	(6.9 ± 0.6)	$\times 10^{-3}$		DESIG=49
Γ ₁₀₁	$\gamma\eta_c$	< 7	$\times 10^{-4}$	CL=90%	DESIG=231
Γ ₁₀₂	$\gamma\eta_c(2S)$	< 9	$\times 10^{-4}$	CL=90%	DESIG=232
Γ ₁₀₃	$\gamma\eta'$	< 1.8	$\times 10^{-4}$	CL=90%	DESIG=213
Γ ₁₀₄	$\gamma\eta$	< 1.5	$\times 10^{-4}$	CL=90%	DESIG=212
Γ ₁₀₅	$\gamma\pi^0$	< 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_8	0	0	
Γ	0	0	-44
	x_2	x_3	x_8

	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 ₈	$e^+ e^-$	$(2.62 \pm 0.18) \times 10^{-4}$	1.4	DESIG=1

$\psi(3770)$ PARTIAL WIDTHS

NODE=M053225

 $\Gamma(e^+e^-)$ Γ_8

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	BESSION	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=M053W1OCCUR=2
OCCUR=2NODE=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=R¹ 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 BESSION 06 (as corrected in BESSION 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. $\psi(3770)$ 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 $e^+e^- \rightarrow$ non- $D\bar{D}$
1.033±0.014 ^{+0.048} _{-0.066}	1.427M 2	BESSION	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 $e^+e^- \rightarrow$ 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 BESSION 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;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
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±0.047±0.023	ABLIKIM	06L BES2	$e^+e^- \rightarrow D^0\bar{D}^0$
0.499±0.013±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
NODE=M053R46

NODE=M053R46;LINKAGE=AB

$\Gamma(D^+ D^-)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

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 ±0.037 ±0.028	ABLIKIM	06L	BES2	$e^+ e^- \rightarrow D^+ D^-$
0.357 ±0.011 ±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
NODE=M053R47

NODE=M053R47;LINKAGE=AB

 $\Gamma(D^0 \bar{D}^0)/\Gamma(D^+ D^-)$ Γ_2/Γ_3

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

1.253 ±0.016 OUR FIT**1.253 ±0.016 OUR AVERAGE**

1.252 ±0.009 ±0.013	5.3M	BONVICINI	14	CLEO	$e^+ e^- \rightarrow D \bar{D}$
1.39 ±0.31 ±0.12		PAKHLOVA	08	BELL	$10.6 e^+ e^- \rightarrow D \bar{D} \gamma$
1.78 ±0.33 ±0.24		AUBERT	07BE	BABR	$e^+ e^- \rightarrow D \bar{D} \gamma$
1.27 ±0.12 ±0.08		ABLIKIM	06L	BES2	$e^+ e^- \rightarrow D \bar{D}$
2.43 ±1.50 ±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 ±0.016 ±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
NODE=M053R5NODE=M053R5;LINKAGE=CH
NODE=M053R5;LINKAGE=DO $\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_4/Γ

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

1.93 ±0.28 OUR AVERAGE

1.89 ±0.20 ±0.20	231 ± 33	ADAM	06	CLEO	$e^+ e^- \rightarrow \psi(3770)$
3.4 ±1.4 ±0.9	17.8 ± 4.8	BAI	05	BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R4
NODE=M053R4 $\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

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

0.080 ±0.025 ±0.016 39 ± 14 ADAM 06 CLEO $e^+ e^- \rightarrow \psi(3770)$ NODE=M053R7
NODE=M053R7 $\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$ Γ_6/Γ

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

87 ±33 ±22 22 ± 10 ADAM 06 CLEO $e^+ e^- \rightarrow \psi(3770)$ NODE=M053R8
NODE=M053R8 $\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$ Γ_7/Γ

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

<28 90 <10 ADAM 06 CLEO $e^+ e^- \rightarrow \psi(3770)$ NODE=M053R9
NODE=M053R9 $\Gamma(e^+ e^-)/\Gamma_{\text{total}}$ Γ_8/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_9/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_{10}/Γ

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

<7 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=M053R83
NODE=M053R83

NODE=M053R83;LINKAGE=AD

 $\Gamma(\omega \eta')/\Gamma_{\text{total}}$ Γ_{11}/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

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

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.

 Γ_{12}/Γ

NODE=M053R85
NODE=M053R85

NODE=M053R85;LINKAGE=AD

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

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

3.1±0.6±0.3

• • • 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.

 Γ_{13}/Γ

NODE=M053R6
NODE=M053R6

NODE=M053R6;LINKAGE=AD

NODE=M053R6;LINKAGE=AK

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

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.

 Γ_{14}/Γ

NODE=M053R86
NODE=M053R86

NODE=M053R86;LINKAGE=AD

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

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.

 Γ_{15}/Γ

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.

 Γ_{16}/Γ

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.

 Γ_{17}/Γ

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.

 Γ_{18}/Γ

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.

 Γ_{19}/Γ

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 $e^+e^- \rightarrow K_S^0 K_L^0$.

 Γ_{20}/Γ

NODE=M053R00
NODE=M053R00

NODE=M053R00;LINKAGE=A

$\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/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=M053R91
NODE=M053R91

NODE=M053R91;LINKAGE=AS

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{22}/Γ

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

 $\Gamma(K_S^0 K_L^0)/\Gamma_{\text{total}}$ Γ_{23}/Γ

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_{24}/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_{25}/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_{26}/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_{27}/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_{28}/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_{29}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R10
NODE=M053R10

NODE=M053R10;LINKAGE=AK

 $\Gamma(3(\pi^+\pi^-)2\pi^0)/\Gamma_{\text{total}}$ Γ_{30}/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_{31}/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 $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R23
NODE=M053R23

NODE=M053R23;LINKAGE=HU
NODE=M053R23;LINKAGE=AK

 $\Gamma(\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{32}/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_{33}/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_{34}/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_{35}/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_{36}/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_{37}/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_{38}/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_{39}/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 $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R28
NODE=M053R28

NODE=M053R28;LINKAGE=HU
NODE=M053R28;LINKAGE=AK

 $\Gamma(K^+K^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-3})	CL%	EVT5	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_{41}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R50
NODE=M053R50

NODE=M053R50;LINKAGE=AK

 $\Gamma(4(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{42}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R52
NODE=M053R52

NODE=M053R52;LINKAGE=AK

 $\Gamma(\phi f_0(980))/\Gamma_{\text{total}}$ Γ_{43}/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_{44}/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_{45}/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_{46}/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_{47}/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_{48}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R60
NODE=M053R60

NODE=M053R60;LINKAGE=AK

 $\Gamma(K^{*0}K^-\pi^+\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{49}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R61
NODE=M053R61

NODE=M053R61;LINKAGE=AK

 $\Gamma(K^{*+}K^-\pi^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{50}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R62
NODE=M053R62

NODE=M053R62;LINKAGE=AK

 $\Gamma(K^+K^-\pi^+\pi^-2\pi^0)/\Gamma_{\text{total}}$ Γ_{51}/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_{52}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R57
NODE=M053R57

NODE=M053R57;LINKAGE=AK

 $\Gamma(K^+K^-2(\pi^+\pi^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{53}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R51
NODE=M053R51

NODE=M053R51;LINKAGE=AK

 $\Gamma(\eta K^+K^-)/\Gamma_{\text{total}}$ Γ_{54}/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 $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6 \text{ nb}$ at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R31
NODE=M053R31

NODE=M053R31;LINKAGE=HU
NODE=M053R31;LINKAGE=AK

 $\Gamma(\eta K^+K^-\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{55}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R78
NODE=M053R78

NODE=M053R78;LINKAGE=AK

 $\Gamma(\rho^0 K^+K^-)/\Gamma_{\text{total}}$ Γ_{56}/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 $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R54
NODE=M053R54

NODE=M053R54;LINKAGE=AK

 $\Gamma(2(K^+K^-))/\Gamma_{\text{total}}$ Γ_{57}/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 $\sigma_{tot}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6 \text{ nb}$ at the resonance.

² Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38 \text{ nb}$.

NODE=M053R33
NODE=M053R33

NODE=M053R33;LINKAGE=HU
NODE=M053R33;LINKAGE=AK

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{58}/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 $\sigma_{\text{tot}}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R34
NODE=M053R34NODE=M053R34;LINKAGE=HU
NODE=M053R34;LINKAGE=AK $\Gamma(2(K^+ K^-)\pi^0)/\Gamma_{\text{total}}$ Γ_{59}/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 $\sigma_{\text{tot}}(e^+ e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R35
NODE=M053R35NODE=M053R35;LINKAGE=HU
NODE=M053R35;LINKAGE=AK $\Gamma(2(K^+ K^-)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{60}/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 $\sigma^{\text{obs}}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.NODE=M053R48
NODE=M053R48

NODE=M053R48;LINKAGE=AK

 $\Gamma(K_S^0 K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<3.2	90	18	ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R64
NODE=M053R64 $\Gamma(K_S^0 K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<13.3	90	40	ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R65
NODE=M053R65 $\Gamma(K_S^0 K^- \rho^+)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<6.6	90	ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R15
NODE=M053R15 $\Gamma(K_S^0 K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<8.7	90	39	ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R66
NODE=M053R66 $\Gamma(K_S^0 K^- \pi^+ \rho^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R16
NODE=M053R16 $\Gamma(K_S^0 K^- \pi^+ \eta)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R17
NODE=M053R17 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<41.8	90	23	ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R67
NODE=M053R67 $\Gamma(K_S^0 K^- 2\pi^+ \pi^- \eta)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<4.8	90	ABLIKIM 09C BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R18
NODE=M053R18 $\Gamma(K_S^0 K^- \pi^+ 2(\pi^+ \pi^-))/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<12.2	90	4	ABLIKIM 08M BES2		$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R68
NODE=M053R68

$\Gamma(K_S^0 K^- \pi^+ 2\pi^0)/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-3})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
<26.5	90	17	ABLIKIM	08M BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R69
NODE=M053R69

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<4.9	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R19
NODE=M053R19

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R75
NODE=M053R75

 $\Gamma(K_S^0 K^- K^+ K^- \pi^+ \eta)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	ABLIKIM	09C BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R76
NODE=M053R76

 $\Gamma(K^{*0} K^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<9.7	90	¹ ABLIKIM	07F BES2	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R55
NODE=M053R55

¹ Assuming that interference effects between resonance and continuum can be neglected and using $\sigma^{obs}(e^+ e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.

NODE=M053R55;LINKAGE=AK

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-6})	EVTs	DOCUMENT ID	TECN	COMMENT

NODE=M053R98
NODE=M053R98

• • • 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	$e^+ e^- \rightarrow \psi(3770)$

OCCUR=2

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.

NODE=M053R98;LINKAGE=C

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

NODE=M053R98;LINKAGE=A

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

NODE=M053R98;LINKAGE=B

 $\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.4	90	^{1,2} ABLIKIM	14O BES3	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R09
NODE=M053R09

• • • 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	$e^+ e^- \rightarrow \psi(3770)$

OCCUR=2

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.

NODE=M053R09;LINKAGE=A

² Solution I of two equivalent solutions in a fit with a resonance interfering with continuum.

NODE=M053R09;LINKAGE=B

³ Solution II of two equivalent solutions in a fit with a resonance interfering with continuum.

NODE=M053R09;LINKAGE=C

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;LINKAGE=AK

 $\Gamma(p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.8	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R36
NODE=M053R36

• • • 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.

NODE=M053R36;LINKAGE=HU

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;LINKAGE=AK

 $\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.2	90	¹ HUANG	06A CLEO	$e^+ e^- \rightarrow \psi(3770)$

NODE=M053R42
NODE=M053R42

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

<4	90	² 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.

NODE=M053R42;LINKAGE=HU

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=M053R42;LINKAGE=AK

$\Gamma(p\bar{p}\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{79}/Γ

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 $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R37
 NODE=M053R37

NODE=M053R37;LINKAGE=HU
 NODE=M053R37;LINKAGE=AK

 $\Gamma(\omega p\bar{p})/\Gamma_{\text{total}}$ Γ_{80}/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. • • •				
<30	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 Using $\sigma^{\text{obs}} = 7.15 \pm 0.27 \pm 0.27$ 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_{81}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R63
 NODE=M053R63

NODE=M053R63;LINKAGE=A
 NODE=M053R63;LINKAGE=AK

 $\Gamma(p\bar{p}2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_{82}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R49
 NODE=M053R49

NODE=M053R49;LINKAGE=AK

 $\Gamma(\eta p\bar{p})/\Gamma_{\text{total}}$ Γ_{83}/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 $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R38
 NODE=M053R38

NODE=M053R38;LINKAGE=HU
 NODE=M053R38;LINKAGE=AK

 $\Gamma(\eta p\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{84}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R79
 NODE=M053R79

NODE=M053R79;LINKAGE=AK

 $\Gamma(\rho^0 p\bar{p})/\Gamma_{\text{total}}$ Γ_{85}/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 $\sigma^{\text{obs}}(e^+e^- \rightarrow \psi(3770)) = 7.15 \pm 0.38$ nb.				

NODE=M053R56
 NODE=M053R56

NODE=M053R56;LINKAGE=AK

 $\Gamma(p\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{86}/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 $\sigma_{\text{tot}}(e^+e^- \rightarrow \psi(3770)) = 7.9 \pm 0.6$ 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=M053R40
 NODE=M053R40

NODE=M053R40;LINKAGE=HU
 NODE=M053R40;LINKAGE=AK

$\Gamma(\eta\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{87}/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

 $\Gamma(\pi^0\rho\bar{p}K^+K^-)/\Gamma_{\text{total}}$ Γ_{88}/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

 $\Gamma(\phi\rho\bar{p})/\Gamma_{\text{total}}$ Γ_{89}/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_{90}/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

 $\Gamma(\Lambda\bar{p}K^+)/\Gamma_{\text{total}}$ Γ_{91}/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

 $\Gamma(\Lambda\bar{p}K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{92}/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_{93}/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_{94}/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_{95}/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_{96}/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

$\Gamma(\Xi^0 \Xi^0)/\Gamma_{\text{total}}$ Γ_{97}/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

NODE=M053240

RADIATIVE DECAYS

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{98}/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=M053R03

NODE=M053R03;LINKAGE=A
NODE=M053R03;LINKAGE=BR

NODE=M053R03;LINKAGE=CO

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{99}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.49±0.23 OUR AVERAGE				

1.98±0.78±0.05 202 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 $e^+ e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

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 $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. 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 $B(\chi_{c1}(1P) \rightarrow K_S^0 K^\pm \pi^\mp) = 0.00349 \pm 0.00029$. 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
NODE=M053R02

OCCUR=2

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_{99}/Γ_4

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_{100}/Γ

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

6.9±0.6 OUR AVERAGE

6.7±0.7±0.1	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	$e^+e^- \rightarrow \psi(3770) \rightarrow \gamma\gamma J/\psi$

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 $B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P)) = (9.79 \pm 0.20) \times 10^{-2}$. 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
NODE=M053R01

NODE=M053R01;LINKAGE=B

NODE=M053R01;LINKAGE=CO

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c2})$ Γ_{100}/Γ_{98}

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

$\Gamma(\gamma\chi_{c0})/\Gamma(\gamma\chi_{c1})$ Γ_{100}/Γ_{99}

VALUE	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_{101}/Γ

VALUE	CL%	DOCUMENT ID	TECN

<7 × 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 $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp) = 2.43 \times 10^{-2}$. We have calculated the best value of $B(\eta_c(1S) \rightarrow K_S^0 K^\pm \pi^\mp)$ as 1/3 of $B(\eta_c(1S) \rightarrow K\bar{K}\pi) = 7.3 \times 10^{-2}$.

NODE=M053R99
NODE=M053R99

NODE=M053R99;LINKAGE=AB

$\Gamma(\gamma\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{102}/Γ

VALUE	CL%	DOCUMENT ID	TECN

<9 × 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_{103}/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_{104}/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_{105}/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

AAIJ	19M	JHEP 1907 035	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=59697
AAIJ	17AD	PL B769 305	R. Aaij <i>et al.</i>	(LHCb Collab.)	REFID=57896
SHAMOV	17	PL B769 187	A.G. Shamov, K.Yu. Todyshev		REFID=57900
ABLIKIM	16B	PL B753 103	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=57126
ABLIKIM	15J	PR D91 092009	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=56775
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)	REFID=56962
ABLIKIM	14H	PR D89 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55899
ABLIKIM	14L	PL B735 101	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55903
ABLIKIM	14O	PR D90 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55906
BONVICINI	14	PR D89 072002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=55798
ABLIKIM	13Q	PR D87 112011	Ablikim M. <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 (errat.)	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	08M	PL B670 179	M. Ablikim <i>et al.</i>	(BES Collab.)	REFID=52569
ABLIKIM	08N	PL B652 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 (errat.)	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 (errat.)	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.

NODE=M212

NODE=M212

 $\psi_2(3823)$ MASS

NODE=M212M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3823.7 ± 0.5 OUR AVERAGE		Error includes scale factor of 1.1. [3822.2 $\pm$ 1.2 MeV OUR 2020 AVERAGE]		
3824.08 $\pm 0.53 \pm 0.14$	137	¹ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
3821.7 $\pm 1.3 \pm 0.7$	19 ± 5	² ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
3823.1 $\pm 1.8 \pm 0.7$	33 ± 10	³ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

NODE=M212M

NEW

¹ Using the measured $m_{\psi_2(3823)} - m_{\psi(2S)} = 137.98 \pm 0.53 \pm 0.14$ MeV.

NODE=M212M;LINKAGE=C

² 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.

NODE=M212M;LINKAGE=B

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.

NODE=M212M;LINKAGE=A

 $m_{\psi_2(3823)} = m_{\psi(2S)}$

NODE=M212A00

NODE=M212A00

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;LINKAGE=A

 $\psi_2(3823)$ WIDTH

NODE=M212W

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
< 5.2 (CL = 90%)		[<16 MeV (CL = 90%) OUR 2020 BEST LIMIT]		
< 5.2	90	¹ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<16	90	² ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
<24	90	³ BHARDWAJ	13 BELL	$B^\pm \rightarrow \chi_{c1} \gamma K^\pm$

NODE=M212W

¹ AAIJ 20S also provides a limit of < 6.6 MeV with 95% CL.

NODE=M212W;LINKAGE=C

² 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.

NODE=M212W;LINKAGE=B

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.

NODE=M212W;LINKAGE=A

 $\psi_2(3823)$ DECAY MODES

NODE=M212215;NODE=M212

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi(1S) \pi^+ \pi^-$	seen
Γ_2 $\chi_{c1} \gamma$	seen
Γ_3 $\chi_{c2} \gamma$	not seen

DESIG=3

DESIG=1

DESIG=2

 $\psi_2(3823)$ BRANCHING RATIOS

NODE=M212225

$\Gamma(J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	137 ± 26	AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$

NODE=M212R00

NODE=M212R00

$\Gamma(\chi_{c1}\gamma)/\Gamma_{\text{total}}$
 Γ_2/Γ

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
seen	33 $\pm$ 10	¹ BHARDWAJ	13	BELL $B^\pm \rightarrow \chi_{c1}\gamma K^\pm$

¹ 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 3.8σ .

NODE=M212R01
NODE=M212R01

NODE=M212R01;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma)/\Gamma_{\text{total}}$
 Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	15S	BES3 $e^+e^- \rightarrow \pi^+\pi^-\chi_{c2}\gamma$
not seen	² BHARDWAJ	13	BELL $B^\pm \rightarrow \chi_{c2}\gamma K^\pm$

¹ 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.

² 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=B

NODE=M212R02;LINKAGE=A

 $\Gamma(\chi_{c2}\gamma)/\Gamma(\chi_{c1}\gamma)$
 Γ_3/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.41	90	BHARDWAJ	13	BELL $B^\pm \rightarrow \chi_{c1/c2}\gamma K^\pm$

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

<0.42	90	¹ ABLIKIM	15S	BES3 $e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$

¹ 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=A

$\psi_2(3823)$ REFERENCES

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=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

NODE=M241215;NODE=M241

Mode	Fraction (Γ_i/Γ)
Γ_1 D^+D^-	seen
Γ_2 $D^0\bar{D}^0$	seen

DESIG=1

DESIG=2

$\psi_3(3842)$ BRANCHING RATIOS

NODE=M241225

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

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AAIJ	19M	LHCB $pp \rightarrow D\bar{D} + \text{anything}$

NODE=M241R01
NODE=M241R01

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

AAIJ 19M JHEP 1907 035 R. Aaij *et al.* (LHCb Collab.)

NODE=M241

REFID=59697

NODE=M237

 $\chi_{c0}(3860)$

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

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 $D = D^0, D^+$.

 $\chi_{c0}(3860)$ 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
$201^{+154+88}_{-67-82}$	CHILIKIN	17 BELL	$e^+e^- \rightarrow J/\psi D\bar{D}$

NODE=M237W

 $\chi_{c0}(3860)$ 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	$e^+e^- \rightarrow J/\psi D^0\bar{D}^0$

NODE=M237R00
 NODE=M237R00

 $\Gamma(D^+D^-)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	CHILIKIN	17 BELL	$e^+e^- \rightarrow J/\psi D^+D^-$

NODE=M237R01
 NODE=M237R01

 $\chi_{c0}(3860)$ REFERENCES

NODE=M237

CHILIKIN 17 PR D95 112003 K. Chilikin *et al.* (BELLE Collab.) JPC

REFID=57995

$\chi_{c1}(3872)$

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

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.

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."

NODE=M176

NODE=M176

 $\chi_{c1}(3872)$ MASS FROM $J/\psi X$ MODE

NODE=M176M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3871.65 ± 0.06 OUR AVERAGE				
[3871.69 $\pm$ 0.17 MeV OUR 2020 AVERAGE]				
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 $\pm$ 1.3	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. • • •				
3871.695 $\pm$ 0.067 $\pm$ 0.068	15.6k	⁶ AAIJ	20AD LHCb	$pp \rightarrow J/\psi\pi^+\pi^-X$
3871.59 $\pm$ 0.06 $\pm$ 0.03	4.2k	⁷ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi\pi^+\pi^-K^+$
3873.3 $\pm$ 1.1 $\pm$ 1.0	45	⁸ ABLIKIM	19V BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
3860.0 $\pm$ 10.4	13.6	^{3,9} AGHASYAN	18A COMP	$\gamma^* N \rightarrow X\pi^\pm N'$
3868.6 $\pm$ 1.2 $\pm$ 0.2	8	¹⁰ AUBERT	06 BABR	$B^0 \rightarrow K_S^0 J/\psi\pi^+\pi^-$
3871.3 $\pm$ 0.6 $\pm$ 0.1	61	¹⁰ AUBERT	06 BABR	$B^- \rightarrow K^- J/\psi\pi^+\pi^-$
3873.4 $\pm$ 1.4	25	¹¹ AUBERT	05R BABR	$B^+ \rightarrow K^+ J/\psi\pi^+\pi^-$
3871.3 $\pm$ 0.7 $\pm$ 0.4	730	^{3,12} ACOSTA	04 CDF2	$p\bar{p} \rightarrow J/\psi\pi^+\pi^-X$
3872.0 $\pm$ 0.6 $\pm$ 0.5	36	¹³ CHOI	03 BELL	$B \rightarrow K\pi^+\pi^- J/\psi$
3836 $\pm$ 13	58	^{3,14} ANTONIAZZI	94 E705	$300\pi^\pm Li \rightarrow J/\psi\pi^+\pi^-X$

NODE=M176M

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.

NODE=M176M;LINKAGE=F

NODE=M176M;LINKAGE=CO

NODE=M176M;LINKAGE=AC

NODE=M176M;LINKAGE=AA

NODE=M176M;LINKAGE=AB

- ⁶ 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.
- ⁷ Using Breit-Wigner parametrization. Superseded by the combined value in AAIJ 20S.
- ⁸ Fit with fixed width and including two resonances, $X(3915)$ and $X(3960)$.
- ⁹ Could be a different state.
- ¹⁰ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3686.093$ MeV. Superseded by AUBERT 08Y.
- ¹¹ Calculated from the corresponding $m_{\chi_{c1}(3872)} - m_{\psi(2S)}$ using $m_{\psi(2S)} = 3685.96$ MeV. Superseded by AUBERT 06.
- ¹² Superseded by AALTONEN 09AU.
- ¹³ Superseded by CHOI 11.
- ¹⁴ 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. • • •				
$3872.9^{+0.6+0.4}_{-0.4-0.5}$	50	^{1,2} AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$
$3875.1^{+0.7}_{-0.5} \pm 0.5$	33 ± 6	² AUBERT	08B BABR	$B \rightarrow \bar{D}^{*0} D^0 K$
$3875.2 \pm 0.7^{+0.9}_{-1.8}$	24 ± 6	^{2,3} GOKHROO	06 BELL	$B \rightarrow D^0 \bar{D}^0 \pi^0 K$
¹ 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.				
² 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.				
³ 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. $[3.0^{+2.1}_{-1.7}]$ MeV OUR 2009 AVERAGE]			
$1.39 \pm 0.24 \pm 0.10$	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	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
• • • 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=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=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

NEW

OCCUR=3

OCCUR=2

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. • • •

$3.9^{+2.8+0.2}_{-1.4-1.1}$	50	¹ AUSHEV	10	BELL	$B \rightarrow \bar{D}^{*0} D^0 K$
$3.0^{+1.9}_{-1.4} \pm 0.9$	33 ± 6	AUBERT	08B	BABR	$B \rightarrow \bar{D}^{*0} D^0 K$

¹With 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=AU

 $\chi_{c1}(3872)$ DECAY MODES

NODE=M176215;NODE=M176

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $e^+ e^-$	$< 3.0 \times 10^{-6}$	90%
Γ_2 $\pi^+ \pi^- J/\psi(1S)$	$(3.6 \pm 0.8) \%$	
Γ_3 $\pi^+ \pi^- \pi^0 J/\psi(1S)$	not seen	
Γ_4 $\omega \eta_c(1S)$	$< 31 \%$	90%
Γ_5 $\omega J/\psi(1S)$	$(4.0 \pm 1.7) \%$	
Γ_6 $\phi \phi$	not seen	
Γ_7 $D^0 \bar{D}^0 \pi^0$	$(46^{+17}_{-19}) \%$	
Γ_8 $\bar{D}^{*0} D^0$	$(35 \pm 9) \%$	
Γ_9 $\gamma \gamma$	$< 11 \%$	90%
Γ_{10} $D^0 \bar{D}^0$	$< 27 \%$	90%
Γ_{11} $D^+ D^-$	$< 18 \%$	90%
Γ_{12} $\pi^0 \chi_{c2}$	$< 4 \%$	90%
Γ_{13} $\pi^0 \chi_{c1}$	$(3.2^{+1.4}_{-1.2}) \%$	
Γ_{14} $\pi^0 \chi_{c0}$	$< 70 \%$	90%
Γ_{15} $\pi^+ \pi^- \eta_c(1S)$	$< 14 \%$	90%
Γ_{16} $\pi^+ \pi^- \chi_{c1}$	$< 7 \times 10^{-3}$	90%
Γ_{17} $p \bar{p}$	$< 2.3 \times 10^{-5}$	95%

Radiative decays

Γ_{18} $\gamma D^+ D^-$	$< 4 \%$	90%
Γ_{19} $\gamma \bar{D}^0 D^0$	$< 6 \%$	90%
Γ_{20} $\gamma J/\psi$	$(8.0 \pm 2.7) \times 10^{-3}$	
Γ_{21} $\gamma \chi_{c1}$	$< 9 \times 10^{-3}$	90%
Γ_{22} $\gamma \chi_{c2}$	$< 3.0 \%$	90%
Γ_{23} $\gamma \psi(2S)$	$(4.3 \pm 1.5) \%$	

C-violating decays

Γ_{24} $\eta J/\psi$	$< 1.7 \%$	90%

DESIG=1

DESIG=2

DESIG=25

DESIG=24

DESIG=13

DESIG=26

DESIG=8

DESIG=12

DESIG=5

DESIG=6

DESIG=7

DESIG=20

DESIG=18

DESIG=19

DESIG=14

DESIG=17

DESIG=16

NODE=M176;CLUMP=B

DESIG=21

DESIG=23

DESIG=9

DESIG=3

DESIG=15

DESIG=11

NODE=M176;CLUMP=A

DESIG=4

 $\chi_{c1}(3872)$ PARTIAL WIDTHS

NODE=M176220

 $\Gamma(e^+ e^-)$ **Γ_1**

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

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

< 4.3	90	¹ ABLIKIM	15v	BES3	$4.0-4.4 e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
< 280	90	² YUAN	04	RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

¹ABLIKIM 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 $\Gamma(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S))/\Gamma = 3\%$.

²Using 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=M176W1
NODE=M176W1

NODE=M176W1;LINKAGE=B

NODE=M176W1;LINKAGE=A

$\chi_{c1}(3872) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M176230

$$\Gamma(\pi^+ \pi^- J/\psi(1S)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_1 / \Gamma$$

NODE=M176G1
NODE=M176G1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 0.13	90	ABLIKIM	15V BES3	4.0–4.4 $e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 6.2	90	^{1,2} AUBERT	05D BABR	10.6 $e^+ e^- \rightarrow K^+ K^- \pi^+ \pi^- \gamma$
< 8.3	90	² DOBBS	05 CLE3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
< 10	90	³ YUAN	04 RVUE	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

¹ 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.

NODE=M176G1;LINKAGE=AU

² Assuming $\chi_{c1}(3872)$ has $J^{PC} = 1^{--}$.

NODE=M176G1;LINKAGE=DO
NODE=M176G1;LINKAGE=A

³ Using BAI 98E data on $e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$. From theoretical calculation of the production cross section and using $B(J/\psi \rightarrow \mu^+ \mu^-) = (5.88 \pm 0.10)\%$.

 $\chi_{c1}(3872) \Gamma(i) \Gamma(\gamma\gamma) / \Gamma(\text{total})$

NODE=M176232

$$\Gamma(\pi^+ \pi^- J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_2 \Gamma_9 / \Gamma$$

NODE=M176H1
NODE=M176H1

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 12.9	90	¹ DOBBS	05 CLE3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi \gamma$

¹ Assuming $\chi_{c1}(3872)$ has positive C parity and spin 0.

NODE=M176H1;LINKAGE=DO

$$\Gamma(\omega J/\psi(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_5 \Gamma_9 / \Gamma$$

NODE=M176G01
NODE=M176G01

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 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;LINKAGE=LE

$$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma) / \Gamma_{\text{total}} \quad \Gamma_{15} \Gamma_9 / \Gamma$$

NODE=M176G02
NODE=M176G02

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
< 11.1	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$

 $\chi_{c1}(3872)$ BRANCHING RATIOS

NODE=M176235

$$\Gamma(\pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}} \quad \Gamma_2 / \Gamma$$

NODE=M176R6
NODE=M176R6

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.036 ± 0.008 OUR AVERAGE				
0.036 ± 0.002 ± 0.007		¹ AAIJ	20S LHCb	$B^+ \rightarrow J/\psi \pi^+ \pi^- K^+$
0.038 ± 0.007 ± 0.008	93	^{2,3} AUBERT	08Y BABR	$B \rightarrow \chi_{c1}(3872) K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	151	⁴ BALA	15 BELL	$B \rightarrow \chi_{c1}(3872) K \pi$
0.058 ± 0.018 ± 0.012	30	⁵ AUBERT	05R BABR	$B^+ \rightarrow K^+ \pi^+ \pi^- J/\psi$
0.061 ± 0.013 ± 0.013	36	⁶ 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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

SYCLP=A
SYCLP=A

² 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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

SYCLP=A

³ superseded by LEES 20C

NODE=M176R6;LINKAGE=E

⁴ 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 $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi) \times B(B^+ \rightarrow \chi_{c1}(3872) K^0 \pi^+) = (10.6 \pm 3.0 \pm 0.9) \times 10^{-6}$.

NODE=M176R6;LINKAGE=C
NODE=M176R6;LINKAGE=A

⁵ 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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R6;LINKAGE=AE

⁶ CHOI 03 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) / \Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872) K^+)] / [B(B^+ \rightarrow \psi(2S) K^+)] / [B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)] =$

NODE=M176R6;LINKAGE=CH

$0.063 \pm 0.012 \pm 0.007$ which we multiply or divide by our best values $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$, $B(B^+ \rightarrow \psi(2S)K^+) = (6.16 \pm 0.21) \times 10^{-4}$, $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (34.68 \pm 0.30) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best values.

$\Gamma(\pi^+\pi^-\pi^0 J/\psi(1S))/\Gamma_{\text{total}}$

Γ_3/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_4/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.31	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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

NODE=M176R24
NODE=M176R24

NODE=M176R24;LINKAGE=A

$\Gamma(\omega J/\psi(1S))/\Gamma_{\text{total}}$

Γ_5/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.027 \pm 0.010 \pm 0.006$	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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. 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_5/Γ_2

VALUE	DOCUMENT ID	TECN	COMMENT
1.1 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.7.		
$1.6^{+0.4}_{-0.3} \pm 0.2$	¹ ABLIKIM 19V	BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
0.8 ± 0.3	² DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
¹ Fit with fixed width and including two resonances, X(3915) and X(3960).			
² 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

NODE=M176R15;LINKAGE=A
NODE=M176R15;LINKAGE=DE

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

Γ_6/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_7/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.46^{+0.17}_{-0.19} \pm 0.09$	[>0.4 OUR 2020 BEST LIMIT]				
$0.46^{+0.17}_{-0.19} \pm 0.09$	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. • • •					
<0.27	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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.					
² 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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.					

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_7/Γ_2

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_8/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

0.35 ± 0.09 ± 0.07 [>0.30 OUR 2020 BEST LIMIT]

0.35 ± 0.09 ± 0.07	41^{+9}_{-8}	¹ AUSHEV	10 BELL	$B^+ \rightarrow D^{*0} \bar{D}^0 K^+$

NODE=M176R13
NODE=M176R13

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

0.75 ± 0.27 ± 0.15	27 ± 6	² AUBERT	08B BABR	$B^+ \rightarrow \bar{D}^{*0} D^0 K^+$

SYCLP=A

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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R13;LINKAGE=AU

 $\Gamma(\bar{D}^{*0} D^0) / \Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_8/Γ_2

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_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.11	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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.2 \times 10^{-4}$.

NODE=M176R09
NODE=M176R09

NODE=M176R09;LINKAGE=A

 $\Gamma(D^0 \bar{D}^0) / \Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.27	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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.2 \times 10^{-4}$.

NODE=M176R3
NODE=M176R3

NODE=M176R3;LINKAGE=A

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.18	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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.2 \times 10^{-4}$.

NODE=M176R4
NODE=M176R4

NODE=M176R4;LINKAGE=A

 $\Gamma(\pi^0 \chi_{c2}) / \Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{12}/Γ_2

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_{13}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.04	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 $B(B^+ \rightarrow \chi_{c1}(3872) K^+) = 2.2 \times 10^{-4}$.

NODE=M176R23
NODE=M176R23

NODE=M176R23;LINKAGE=A

 $\Gamma(\pi^0 \chi_{c1}) / \Gamma(\pi^+ \pi^- J/\psi(1S))$ Γ_{13}/Γ_2

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

$88^{+33}_{-27} \pm 10$	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_{14}/Γ_2

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<19	90	ABLIKIM	19U BES3	$e^+ e^- \rightarrow \gamma \chi_{c1}(3872)$

NODE=M176R04
NODE=M176R04

$\Gamma(\pi^+\pi^-\eta_c(1S))/\Gamma_{\text{total}}$
 Γ_{15}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.14	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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

NODE=M176R22
NODE=M176R22

NODE=M176R22;LINKAGE=A

 $\Gamma(\pi^+\pi^-\chi_{c1})/\Gamma_{\text{total}}$
 Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<7 × 10⁻³ (CL = 90%)		[not seen OUR 2020 BEST LIMIT]		
<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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

NODE=M176R00
NODE=M176R00

NODE=M176R00;LINKAGE=A

 $\Gamma(p\bar{p})/\Gamma_{\text{total}}$
 Γ_{17}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.3 × 10⁻⁵ (CL = 95%)		[not seen OUR 2020 BEST LIMIT]		
<2.3 × 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. • • •				
<8 × 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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				
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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

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_{18}/Γ_2

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_{19}/Γ_2

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_{20}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0080^{+0.0022}_{-0.0021} ± 0.0016		¹ BHARDWAJ 11	BELL	$B^\pm \rightarrow \gamma J/\psi K^\pm$

NODE=M176R7
NODE=M176R7
SYCLP=A

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

0.013 ± 0.004 ± 0.003	20	² AUBERT	09B BABR	$B^+ \rightarrow \gamma J/\psi K^+$
0.015 ± 0.005 ± 0.003	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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R7;LINKAGE=BA

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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M176R7;LINKAGE=AU

 $\Gamma(\gamma J/\psi)/\Gamma(\pi^+\pi^- J/\psi(1S))$
 Γ_{20}/Γ_2

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_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-3}$	90	¹ BHARDWAJ 13	BELL	$B^{\pm} \rightarrow \chi_{c1} \gamma K^{\pm}$
¹ BHARDWAJ 13 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\chi_{c1})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 1.9 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

NODE=M176R08
NODE=M176R08

NODE=M176R08;LINKAGE=B

 $\Gamma(\gamma\chi_{c1})/\Gamma(\pi^+\pi^-J/\psi(1S))$
 Γ_{21}/Γ_2

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_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.030 (CL = 90%)	[not seen OUR 2019 BEST LIMIT]			
<0.030	90	¹ BHARDWAJ 13	BELL	$B^{\pm} \rightarrow \chi_{c2} \gamma K^{\pm}$
¹ BHARDWAJ 13 reports $[\Gamma(\chi_{c1}(3872) \rightarrow \gamma\chi_{c2})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(3872)K^+)] < 6.7 \times 10^{-6}$ which we divide by our best value $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.				

NODE=M176R01
NODE=M176R01

NODE=M176R01;LINKAGE=B

 $\Gamma(\gamma\psi(2S))/\Gamma_{\text{total}}$
 Γ_{23}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.043 \pm 0.012 \pm 0.009$	25 ± 7	¹ AUBERT 09B	BABR	$B^+ \rightarrow \gamma\psi(2S)K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	36 ± 9	² AAIJ	14AH LHCb	$B^+ \rightarrow \gamma\psi(2S)K^+$
not seen		³ BHARDWAJ 11	BELL	$B^+ \rightarrow \gamma\psi(2S)K^+$

NODE=M176R10
NODE=M176R10

NODE=M176R10;LINKAGE=AU

¹ 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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = (2.2 \pm 0.5) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ .

³ 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.

NODE=M176R10;LINKAGE=A

NODE=M176R10;LINKAGE=BH

 $\Gamma(\gamma\psi(2S))/\Gamma(\pi^+\pi^-J/\psi(1S))$
 Γ_{23}/Γ_2

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_{23}/Γ_{20}

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
2.6 ± 0.6	OUR AVERAGE				
$2.46 \pm 0.64 \pm 0.29$	36 ± 9	¹ AAIJ	14AH LHCb	BABR	$B^+ \rightarrow \gamma\psi(2S)K^+$
3.4 ± 1.4		AUBERT 09B	BABR		$B^+ \rightarrow \gamma c\bar{c}K'$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.1	90	BHARDWAJ 11	BELL		$B^+ \rightarrow \gamma\psi(2S)K^+$

NODE=M176R11
NODE=M176R11

NODE=M176R11;LINKAGE=A

¹ From 36.4 ± 9.0 events of $\chi_{c1}(3872) \rightarrow J/\psi\gamma$ decays with a statistical significance of 4.4σ .

C-violating decays

 $\Gamma(\eta J/\psi)/\Gamma_{\text{total}}$
 Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.017 (CL = 90%)	[<0.4 (CL = 90%) OUR 2020 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. • • •				
<0.035	90	³ AUBERT 04Y	BABR	$B \rightarrow K\eta J/\psi$

NODE=M176R2
NODE=M176R2

NODE=M176R2;LINKAGE=A

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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.

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 $B(B^+ \rightarrow \chi_{c1}(3872)K^+) = 2.2 \times 10^{-4}$.

NODE=M176R2;LINKAGE=C

NODE=M176R2;LINKAGE=D

$\chi_{c1}(3872)$ REFERENCES

NODE=M176

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
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

$Z_c(3900)$

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

was $X(3900)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Charged $Z_c(3900)$ 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 $Z_c(3900)$ 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.

 $Z_c(3900)$ 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. [3888.4 $\pm$ 2.5 MeV OUR 2020 AVERAGE Scale factor = 1.7]			
$3893.1 \pm 2.2 \pm 3.0$		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	$\pm$ 1.96 TeV $p\bar{p} \rightarrow J/\psi\pi^+\pi^- X$
$3881.2 \pm 4.2 \pm 52.7$	6k	⁴ ABLIKIM	17J	BES3	$\pm$ $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$3885.7^{+4.3}_{-5.7} \pm 8.4$		^{2,4} ABLIKIM	15AB	BES3	0 $e^+e^- \rightarrow \pi^0(D\bar{D}^*)^0$
$3881.7 \pm 1.6 \pm 1.6$	1.2k	^{2,4} ABLIKIM	15AC	BES3	$\pm$ $e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
$3883.9 \pm 1.5 \pm 4.2$	1.2k	^{2,4} ABLIKIM	14A	BES3	$\pm$ $e^+e^- \rightarrow \pi^\pm(D\bar{D}^*)^\mp$
$3894.5 \pm 6.6 \pm 4.5$	159	² LIU	13B	BELL	$\pm$ $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$
$3886 \pm 4 \pm 2$	81	^{2,5} XIAO	13A		$\pm$ 4.17 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$
$3904 \pm 9 \pm 5$	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. • • •					
$3895.0 \pm 5.2^{+4.0}_{-2.7}$	502	^{2,6} ABAZOV	18B	D0	$\pm$ 1.96 TeV $p\bar{p} \rightarrow J/\psi\pi^+\pi^- X$
$3894.8 \pm 2.3 \pm 3.2$	356	^{2,7} ABLIKIM	15U	BES3	0 $e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
$3899.0 \pm 3.6 \pm 4.9$	307	^{2,8} ABLIKIM	13T	BES3	$\pm$ $e^+e^- \rightarrow \pi^+\pi^- J/\psi$

¹ Pole mass obtained from a fit to a relativistic Breit-Wigner.

² Neglecting interference between the $Z_c(3900)$ 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 $Z_c(3900)$ 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

NEW

OCCUR=2

NODE=M210M;LINKAGE=L

NODE=M210M;LINKAGE=A

NODE=M210M;LINKAGE=G

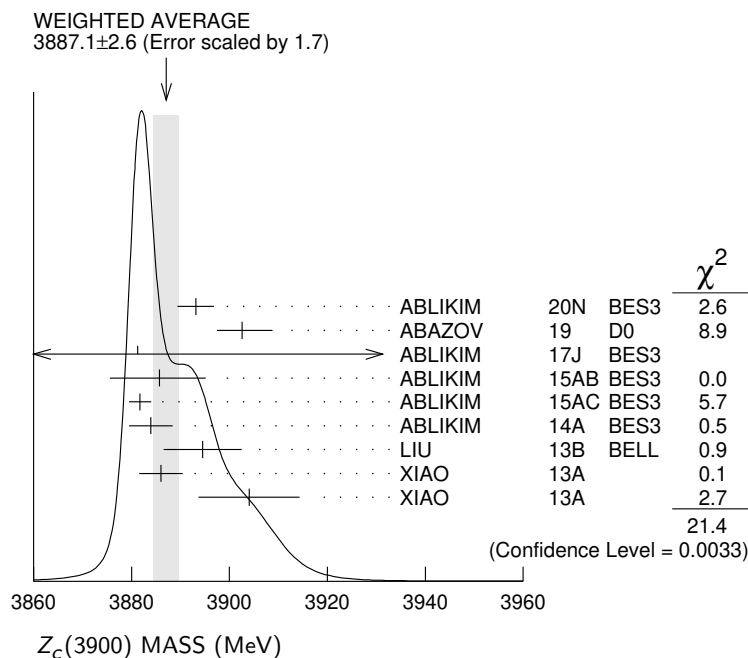
NODE=M210M;LINKAGE=E

NODE=M210M;LINKAGE=B

NODE=M210M;LINKAGE=F

NODE=M210M;LINKAGE=J

NODE=M210M;LINKAGE=K



$Z_c(3900)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT	
28.4± 2.6 OUR AVERAGE [28.3 ± 2.5 MeV OUR 2020 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 ±15 -12		^{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 $Z_c(3900)$ 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

NEW

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

$Z_c(3900)$ 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 $\eta_c(1S) \rho(770)^\pm$	
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

DESIG=3;OUR EVAL;→ UNCHECKED ←

DESIG=8

DESIG=9

DESIG=4

DESIG=5

DESIG=6

DESIG=7

$Z_c(3900)$ 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 $p\bar{p} \rightarrow \pi^+\pi^-\pi^0 J/\psi$ (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 $B(Z_c(3900)^\pm \rightarrow J/\psi\pi^\pm) \sigma(\gamma N \rightarrow Z_c(3900)^\pm N) / \sigma(\gamma N \rightarrow J/\psi N) < 3.7 \times 10^{-3}$ at 90% CL.³ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.NODE=M210R01
NODE=M210R01NODE=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=M210R11¹ 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

$\Gamma((D\bar{D}^*)^\pm)/\Gamma(J/\psi\pi)$		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

$\Gamma(D^0 D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$		Γ_6/Γ				
VALUE		DOCUMENT ID	TECN	CHG	COMMENT	
seen		ABLIKIM	15AC	BES3	$\pm$	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$
seen		ABLIKIM	14A	BES3	$\pm$	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} + \text{c.c.}$

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

$\Gamma(\eta_c(1S)\rho(770)^\pm)/\Gamma(J/\psi\pi)$		Γ_4/Γ_1				
VALUE	EVTs	DOCUMENT ID	TECN	CHG	COMMENT	
2.3 ± 0.8	332	1 ABLIKIM	19BC	BES3	$e^+e^- \rightarrow \pi^+\pi^-\pi^0\eta_c(1S)$	

¹ Using $e^+e^- \rightarrow \pi^\mp(Z_c(3900)^\pm \rightarrow J/\psi\pi^\pm)$ cross section at 4.23 and 4.26 GeV from ABLIKIM 17J.NODE=M210R12
NODE=M210R12

NODE=M210R12;LINKAGE=A

$\Gamma(D^+ D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$		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

$\Gamma(D^0 \bar{D}^{*0} + c.c.) / \Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
seen	ABLIKIM	15AB BES3	0	$e^+ e^- \rightarrow \pi^0 (D \bar{D}^*)^0$

 Γ_{11} / Γ

NODE=M210R07
 NODE=M210R07

 $\Gamma(D^+ D^{*-} + c.c.) / \Gamma(D^0 \bar{D}^{*0} + c.c.)$

VALUE	DOCUMENT ID	TECN	CHG	COMMENT
$0.96 \pm 0.18 \pm 0.12$	ABLIKIM	15AB BES3	0	$e^+ e^- \rightarrow \pi^0 (D \bar{D}^*)^0$

 $\Gamma_{10} / \Gamma_{11}$

NODE=M210R08
 NODE=M210R08

Z_c(3900) REFERENCES

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 (errata.)	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>	(BESIII Collab.)
XIAO	13A	PL B727 366	T. Xiao <i>et al.</i>	(NWES)

NODE=M210

REFID=60338
 REFID=59903
 REFID=60036
 REFID=59442
 REFID=57950
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 REFID=55409
 REFID=55635
 REFID=55410
 REFID=55593

X(3915)

$$J^G(J^{PC}) = 0^+(0 \text{ or } 2^{++})$$

was $\chi_{c0}(3915)$

The experimental analysis prefers $J^{PC} = 0^{++}$. However, a re-analysis presented in ZHOU 15C shows that if helicity-2 dominance assumption is abandoned and a sizable helicity-0 component is allowed, a $J^{PC} = 2^{++}$ assignment is possible.

NODE=M159

NODE=M159

X(3915) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3918.4 ± 1.9 OUR AVERAGE				
$3919.4 \pm 2.2 \pm 1.6$	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
$3919.1^{+3.8}_{-3.4} \pm 2.0$		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
$3915 \pm 3 \pm 2$	49 ± 15	UEHARA	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
$3943 \pm 11 \pm 13$	58 ± 11	¹ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3926.4 \pm 2.2 \pm 1.2$		² ABLIKIM	19v BES	$e^+ e^- \rightarrow \gamma \omega J/\psi$
$3914.6^{+3.8}_{-3.4} \pm 2.0$		¹ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

NODE=M159M

NODE=M159M

¹ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.

² Could also be X(3940). Significance 3.1 σ . Fit with additional resonance at 3963.7 $\pm$ 5.7 MeV, significance 3.4 σ .

NODE=M159M;LINKAGE=CH
 NODE=M159M;LINKAGE=A

X(3915) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
20 ± 5 OUR AVERAGE				Error includes scale factor of 1.1.
$13 \pm 6 \pm 3$	59	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
$31^{+10}_{-8} \pm 5$		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
$17 \pm 10 \pm 3$	49	UEHARA	10 BELL	$10.6 e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
$87 \pm 22 \pm 26$	58	³ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3.8 \pm 7.5 \pm 2.6$		⁴ ABLIKIM	19v BES	$e^+ e^- \rightarrow \gamma \omega J/\psi$
$34^{+12}_{-8} \pm 5$		³ AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

NODE=M159W

NODE=M159W

³ $\omega J/\psi$ threshold enhancement fitted as an S-wave Breit-Wigner resonance.

⁴ Could also be X(3940). Significance 3.1 σ . Fit with additional resonance at 3963.7 $\pm$ 5.7 MeV, significance 3.4 σ .

NODE=M159W;LINKAGE=CH
 NODE=M159W;LINKAGE=A

X(3915) DECAY MODES

NODE=M159215;NODE=M159

Mode	Fraction (Γ_i/Γ)
Γ_1 $\omega J/\psi$	seen
Γ_2 $\bar{D}^{*0} D^0$	
Γ_3 $\pi^+ \pi^- \eta_c(1S)$	not seen
Γ_4 $\eta_c \eta$	not seen
Γ_5 $\eta_c \pi^0$	not seen
Γ_6 $K \bar{K}$	not seen
Γ_7 $\gamma\gamma$	seen
Γ_8 $\pi^0 \chi_{c1}$	

DESIG=1;OUR EST;→ UNCHECKED ←
DESIG=3
DESIG=4;OUR EVAL;→ UNCHECKED ←
DESIG=6
DESIG=7
DESIG=5;OUR EVAL;→ UNCHECKED ←
DESIG=2
DESIG=8

X(3915) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M159220

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_7/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
54± 9 OUR AVERAGE					
52±10±3	59 ± 10	⁵ LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
61±17±8	49 ± 15	⁵ 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	⁶ UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
⁵ For $J^P = 0^+$.					
⁶ For $J^P = 2^+$, helicity-2.					

NODE=M159G01
NODE=M159G01

OCCUR=2

NODE=M159G01;LINKAGE=UH
NODE=M159G01;LINKAGE=UR

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_7/\Gamma$
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

$\Gamma(K \bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_6\Gamma_7/\Gamma$
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

X(3915) BRANCHING RATIOS

NODE=M159225

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		⁷ DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$	
seen		⁸ CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	
⁷ DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow X(3915)K^\pm) \times B(X(3915) \rightarrow J/\psi\omega) = (3.0^{+0.7+0.5}_{-0.6-0.3}) \times 10^{-5}$ and $B(B^0 \rightarrow X(3915)K^0) \times B(X(3915) \rightarrow J/\psi\omega) = (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$.					
⁸ CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi\omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$.					

NODE=M159R03
NODE=M159R03

NODE=M159R03;LINKAGE=DE

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	⁹ AUSHEV	10 BELL	$B \rightarrow \bar{D}^{*0} D^0 K$	
⁹ By combining the upper limit $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow D^{*0} \bar{D}^0) < 0.67 \times 10^{-4}$ from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$.					

NODE=M159R02
NODE=M159R02

NODE=M159R02;LINKAGE=AU

$\Gamma(\eta_c \eta)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
not seen	90	¹⁰ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \eta$	
¹⁰ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \eta) < 4.7 \times 10^{-5}$ at 90% CL.					

NODE=M159R00
NODE=M159R00

OCCUR=2

NODE=M159R00;LINKAGE=A

$\Gamma(\eta_c \pi^0)/\Gamma_{\text{total}}$					Γ_5/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
not seen	90	¹¹ VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^0$	
¹¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \pi^0) < 1.7 \times 10^{-5}$ at 90% CL.					

NODE=M159R04
NODE=M159R04

OCCUR=2

NODE=M159R04;LINKAGE=A

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					Γ_7/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_8/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
not seen	42 ± 14	¹² BHARDWAJ	19 BELL	$B^\pm \rightarrow \chi_{c1}\pi^0 K^\pm$	
¹² BHARDWAJ 19 reports $B(B^+ \rightarrow K^+ X(3915)) \times B(X(3915) \rightarrow \chi_{c1}\pi^0) < 3.8 \times 10^{-5}$ at 90% CL. A signal significance 2.3 standard deviations.					

NODE=M159R05
NODE=M159R05

NODE=M159R05;LINKAGE=A

X(3915) REFERENCES

NODE=M159

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.)

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
3922.2 ± 1.0 OUR AVERAGE		Error includes scale factor of 1.6.		
3921.9 ± 0.6 ± 0.2		¹ 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 $e^+e^- \rightarrow e^+e^-D\bar{D}$
¹ Measured in prompt hadroproduction.				

NODE=M050M

NODE=M050M;LINKAGE=A

$\chi_{c2}(3930)$ WIDTH

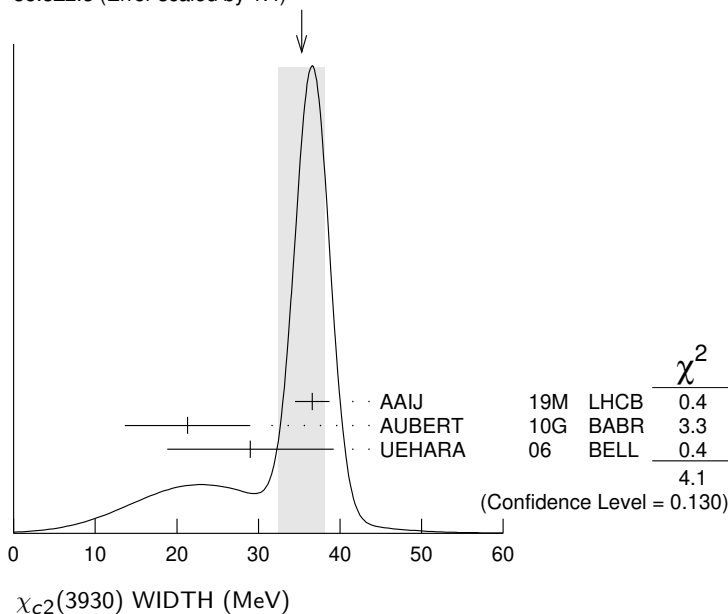
NODE=M050W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
35.3 ± 2.8 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
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 $e^+e^- \rightarrow e^+e^-D\bar{D}$
² Measured in prompt hadroproduction.				

NODE=M050W

NODE=M050W;LINKAGE=A

WEIGHTED AVERAGE
35.3±2.8 (Error scaled by 1.4)



$\chi_{c2}(3930)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\gamma\gamma$	seen
Γ_2 $K\bar{K}\pi$	
Γ_3 $K^+K^-\pi^+\pi^-\pi^0$	
Γ_4 $D\bar{D}$	seen
Γ_5 D^+D^-	seen
Γ_6 $D^0\bar{D}^0$	seen
Γ_7 $\pi^+\pi^-\eta_c(1S)$	not seen
Γ_8 $K\bar{K}$	not seen

NODE=M050215;NODE=M050

DESIG=1;OUR EVAL;→ UNCHECKED ←
DESIG=5
DESIG=6
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 ←

$\chi_{c2}(3930)$ PARTIAL WIDTHS

$\chi_{c2}(3930)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(K\bar{K}\pi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<2.1 90 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K_S^0 K^\pm \pi^\mp$	

NODE=M050220

NODE=M050222

NODE=M050G01
NODE=M050G01

$\Gamma(K^+K^-\pi^+\pi^-\pi^0) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<3.4 90 DEL-AMO-SA..11M BABR $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$	

NODE=M050G02
NODE=M050G02

$\Gamma(D\bar{D}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_4\Gamma_1/\Gamma$
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 $e^+e^- \rightarrow e^+e^- D\bar{D}$	
0.18±0.05±0.03 64 ³ UEHARA 06 BELL 10.6 $e^+e^- \rightarrow e^+e^- D\bar{D}$	
³ Assuming $B(D^+D^-) = 0.89 B(D^0\bar{D}^0)$.	

NODE=M050G1
NODE=M050G1

NODE=M050G1;LINKAGE=UE

$\Gamma(\pi^+\pi^-\eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_7\Gamma_1/\Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<18 90 LEES 12AE BABR $e^+e^- \rightarrow e^+e^-\pi^+\pi^-\eta_c$	

NODE=M050G03
NODE=M050G03

$\Gamma(K\bar{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$	$\Gamma_8\Gamma_1/\Gamma$
VALUE (eV) CL% DOCUMENT ID TECN COMMENT	
<0.256 90 UEHARA 13 BELL $\gamma\gamma \rightarrow K_S^0 K_S^0$	

NODE=M050G04
NODE=M050G04

$\chi_{c2}(3930)$ BRANCHING RATIOS $\Gamma(D^+ D^-)/\Gamma(D^0 \bar{D}^0)$ Γ_5/Γ_6

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$0.74 \pm 0.43 \pm 0.16$	64	UEHARA	06	BELL $10.6 e^+ e^- \rightarrow e^+ e^- D \bar{D}$

NODE=M050225

NODE=M050R01
NODE=M050R01 $\chi_{c2}(3930)$ REFERENCES

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.)

NODE=M050

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 $e^+ e^- \rightarrow J/\psi X$.

NODE=M029

NODE=M029

 $X(3940)$ 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 $e^+ e^- \rightarrow J/\psi(c\bar{c})$

NODE=M029M

NODE=M029M

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.

OCCUR=2

NODE=M029M;LINKAGE=EB
NODE=M029M;LINKAGE=EM $X(3940)$ 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 $e^+ e^- \rightarrow J/\psi X$

NODE=M029W

NODE=M029W

 $X(3940)$ 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

NODE=M029215;NODE=M029

DESIG=1;OUR EVAL;→ UNCHECKED ←

DESIG=2;OUR EVAL;→ UNCHECKED ←

DESIG=3;OUR EVAL;→ UNCHECKED ←

 $X(3940)$ BRANCHING RATIOS $\Gamma(D \bar{D}^* + \text{c.c.})/\Gamma_{\text{total}}$ Γ_1/Γ

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/c² may consist of several states.

NODE=M029225

NODE=M029R01
NODE=M029R01

NODE=M029R01;LINKAGE=AB

NODE=M029R01;LINKAGE=AE

 $\Gamma(D \bar{D})/\Gamma_{\text{total}}$ 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/c² may consist of several states.NODE=M029R02
NODE=M029R02

NODE=M029R02;LINKAGE=AB

NODE=M029R02;LINKAGE=AE

$\Gamma(J/\psi\omega)/\Gamma_{\text{total}}$ 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/c² may consist of several states.

NODE=M029R03
NODE=M029R03

NODE=M029R03;LINKAGE=AB
NODE=M029R03;LINKAGE=AE

$X(3940)$ 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

REFID=52302
REFID=51627

NODE=M213

$X(4020)^\pm$

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

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M213

Charged $X(4020)$ 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 $X(4020)$ 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 $X(4020)$ together as manifestations of a single $I = 1$ particle.

$X(4020)^\pm$ MASS

NODE=M213M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

4024.1 ± 1.9 OUR AVERAGE

4025.5 ^{+2.0} _{-4.7} ± 3.1	116	¹ ABLIKIM	15AA BES3	0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
4026.3 ± 2.6 ± 3.7	401	¹ ABLIKIM	14B BES3	±	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
4023.9 ± 2.2 ± 3.8	61	^{1,2} ABLIKIM	14P BES3	0	$e^+e^- \rightarrow \pi^0\pi^0h_c$
4022.9 ± 0.8 ± 2.7	253	¹ ABLIKIM	13X BES3	±	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the $X(4020)$ and non-resonant continuum.

² Assuming $J^P = 1^+$ and width of 7.9 ± 2.6 MeV.

NODE=M213M;LINKAGE=AB
NODE=M213M;LINKAGE=B

$X(4020)^\pm$ WIDTH

NODE=M213W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	CHG	COMMENT

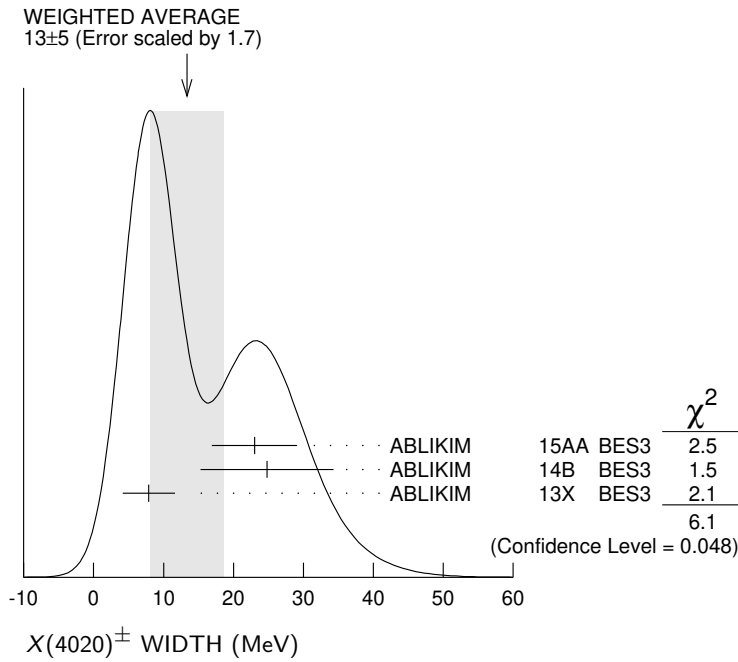
13 ± 5 OUR AVERAGE

Error includes scale factor of 1.7. See the ideogram below.

23.0 ± 6.0 ± 1.0	116	¹ ABLIKIM	15AA BES3	0	$e^+e^- \rightarrow (D^*\bar{D}^*)^0\pi^0$
24.8 ± 5.6 ± 7.7	401	¹ ABLIKIM	14B BES3	±	$e^+e^- \rightarrow (D^*\bar{D}^*)^\pm\pi^\mp$
7.9 ± 2.7 ± 2.6	253	¹ ABLIKIM	13X BES3	±	$e^+e^- \rightarrow \pi^+\pi^-h_c$

¹ Neglecting interference between the $X(4020)$ and non-resonant continuum.

NODE=M213W;LINKAGE=AB



$X(4020)^\pm$ 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

$X(4020)^\pm$ 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=M213R02

¹ Neglecting interference between the $X(4020)$ 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=M213R00

¹ VINOKUROVA 15 reports $B(B^+ \rightarrow K^+X(4020)^0) \times B(X \rightarrow \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ 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=M213R05

¹ 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

 $X(4020)^\pm$ 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=M072

 $\psi(4040)$

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

 $\psi(4040)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4039 ± 1 OUR ESTIMATE			
4039.6 ± 4.3	¹ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4034 ± 6	² MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
4037 ± 2	³ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
4040 ± 1	⁴ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
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

NODE=M072M
 → UNCHECKED ←

OCCUR=2

NODE=M072M;LINKAGE=AB

NODE=M072M;LINKAGE=MO

NODE=M072M;LINKAGE=ST
 NODE=M072M;LINKAGE=SE

 $\psi(4040)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
80 ± 10 OUR ESTIMATE			
84.5 ± 12.3	⁵ ABLIKIM	08D BES2	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
87 ± 11	⁶ MO	10 RVUE	$e^+e^- \rightarrow \text{hadrons}$
85 ± 10	⁷ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
89 ± 6	⁸ SETH	05A RVUE	$e^+e^- \rightarrow \text{hadrons}$
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

NODE=M072W
 → UNCHECKED ←

OCCUR=2

NODE=M072W;LINKAGE=AB

NODE=M072W;LINKAGE=MO

NODE=M072W;LINKAGE=ST
 NODE=M072W;LINKAGE=SE

$\psi(4040)$ 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=M072215;NODE=M072

NODE=M072

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$	
Γ_2	$D\bar{D}$	seen	
Γ_3	$D^0\bar{D}^0$	seen	
Γ_4	D^+D^-	seen	
Γ_5	$D^*\bar{D} + \text{c.c.}$	seen	
Γ_6	$D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
Γ_7	$D^*(2010)^+D^- + \text{c.c.}$	seen	
Γ_8	$D^*\bar{D}^*$	seen	
Γ_9	$D^*(2007)^0\bar{D}^*(2007)^0$	seen	
Γ_{10}	$D^*(2010)^+D^*(2010)^-$	seen	
Γ_{11}	$D\bar{D}\pi$ (excl. $D^*\bar{D}$)		
Γ_{12}	$D^0D^-\pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0\bar{D}^0 + \text{c.c.}$, $D^*(2010)^+D^- + \text{c.c.}$)	not seen	
Γ_{13}	$D\bar{D}^*\pi$ (excl. $D^*\bar{D}^*$)	not seen	
Γ_{14}	$D^0\bar{D}^{*-}\pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+D^*(2010)^-$)	seen	
Γ_{15}	$D_s^+D_s^-$	seen	
Γ_{16}	$J/\psi(1S)$ hadrons		
Γ_{17}	$J/\psi\pi^+\pi^-$	$< 4 \times 10^{-3}$	90%
Γ_{18}	$J/\psi\pi^0\pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{19}	$J/\psi\eta$	$(5.2 \pm 0.7) \times 10^{-3}$	
Γ_{20}	$J/\psi\pi^0$	$< 2.8 \times 10^{-4}$	90%
Γ_{21}	$J/\psi\pi^+\pi^-\pi^0$	$< 2 \times 10^{-3}$	90%
Γ_{22}	$\chi_{c1}\gamma$	$< 3.4 \times 10^{-3}$	90%
Γ_{23}	$\chi_{c2}\gamma$	$< 5 \times 10^{-3}$	90%
Γ_{24}	$\chi_{c1}\pi^+\pi^-\pi^0$	$< 1.1 \%$	90%
Γ_{25}	$\chi_{c2}\pi^+\pi^-\pi^0$	$< 3.2 \%$	90%
Γ_{26}	$h_c(1P)\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%
Γ_{27}	$\phi\pi^+\pi^-$	$< 3 \times 10^{-3}$	90%
Γ_{28}	$\Lambda\bar{\Lambda}\pi^+\pi^-$	$< 2.9 \times 10^{-4}$	90%
Γ_{29}	$\Lambda\bar{\Lambda}\pi^0$	$< 9 \times 10^{-5}$	90%
Γ_{30}	$\Lambda\bar{\Lambda}\eta$	$< 3.0 \times 10^{-4}$	90%
Γ_{31}	$\Sigma^+\bar{\Sigma}^-$	$< 1.3 \times 10^{-4}$	90%
Γ_{32}	$\Sigma^0\bar{\Sigma}^0$	$< 7 \times 10^{-5}$	90%
Γ_{33}	$\Xi^+\bar{\Xi}^-$	$< 1.6 \times 10^{-4}$	90%
Γ_{34}	$\Xi^0\bar{\Xi}^0$	$< 1.8 \times 10^{-4}$	90%
Γ_{35}	$\mu^+\mu^-$		

DESIG=5

DESIG=17;OUR EST;→ UNCHECKED ←

DESIG=1

DESIG=18

DESIG=19;OUR EST;→ UNCHECKED ←

DESIG=2

DESIG=20

DESIG=21;OUR EST;→ UNCHECKED ←

DESIG=3

DESIG=22

DESIG=23

DESIG=24

DESIG=25

DESIG=26

DESIG=27

DESIG=4

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=32

DESIG=33

DESIG=34

DESIG=35

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

 $e^+e^- \rightarrow \text{hadrons}$

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

0.6 to 1.4

¹⁰ MO

10

RVUE

 $e^+e^- \rightarrow \text{hadrons}$ 0.88 ± 0.11 ¹¹ SETH

05A

RVUE

 $e^+e^- \rightarrow \text{hadrons}$ 0.91 ± 0.13 ¹² SETH

05A

RVUE

 $e^+e^- \rightarrow \text{hadrons}$ 0.75 ± 0.15

BRANDELIK

78C

DASP

 e^+e^-

NODE=M072W5

NODE=M072W5

→ UNCHECKED ←

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

$\psi(4040) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	¹³ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

¹³ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M072235

NODE=M072G01
NODE=M072G01

NODE=M072G01;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{23}\Gamma_1/\Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.6	90	¹⁴ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

¹⁴ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M072G02
NODE=M072G02

NODE=M072G02;LINKAGE=A

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

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

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
NODE=M072R00

OCCUR=2

OCCUR=3

NODE=M072R00;LINKAGE=A

NODE=M072R00;LINKAGE=B

NODE=M072R00;LINKAGE=C

$\psi(4040) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$

$\Gamma(J/\psi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma \times \Gamma_1/\Gamma$

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	¹⁸ WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$
12.8 ± 2.1 ± 1.9	¹⁹ WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

¹⁸ Solution I of two equivalent solutions in a fit using two interfering resonances. Mass and width fixed at 4039 MeV and 80 MeV, respectively.

¹⁹ 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=M072230

NODE=M072R25
NODE=M072R25

OCCUR=2

NODE=M072R25;LINKAGE=A

NODE=M072R25;LINKAGE=B

$\psi(4040)$ BRANCHING RATIOS

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

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=M072225

NODE=M072R4
NODE=M072R4

$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$

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

$\Gamma(D^+D^-)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$

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

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D} + \text{c.c.})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.24±0.05±0.12	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}$

 Γ_2/Γ_5

 NODE=M072R12
 NODE=M072R12

$$\Gamma(D^0\bar{D}^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.05±0.03	²⁰ GOLDHABER 77	MRK1	e^+e^-

 Γ_3/Γ_6

 NODE=M072R1
 NODE=M072R1

²⁰ Phase-space factor (p^3) explicitly removed.

NODE=M072R;LINKAGE=P

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^0\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^0$

 Γ_6/Γ

 NODE=M072R16
 NODE=M072R16

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	²¹ ZHUKOVA 18	BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^-\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^-$

 Γ_7/Γ

 NODE=M072R17
 NODE=M072R17
 OCCUR=3

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

seen	PAKHLOVA 07	BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

²¹ Supersedes PAKHLOVA 07.

NODE=M072R17;LINKAGE=C

$$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.95±0.09±0.10	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^*\bar{D}$

 Γ_7/Γ_6

 NODE=M072R11
 NODE=M072R11

$$\Gamma(D^*\bar{D}^*)/\Gamma(D^*\bar{D} + \text{c.c.})$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.18±0.14±0.03	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

 Γ_8/Γ_5

 NODE=M072R13
 NODE=M072R13

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

 Γ_9/Γ

 NODE=M072R18
 NODE=M072R18

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})$$

VALUE	DOCUMENT ID	TECN	COMMENT
32.0±12.0	²² GOLDHABER 77	MRK1	e^+e^-

 Γ_9/Γ_6

 NODE=M072R2
 NODE=M072R2

²² Phase-space factor (p^3) explicitly removed.

NODE=M072R2;LINKAGE=P

$$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	²³ ZHUKOVA 18	BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$
seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D^{*+}D^{*-}$

 Γ_{10}/Γ

 NODE=M072R19
 NODE=M072R19
 OCCUR=2

• • • 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=M072R19;LINKAGE=B

$$\Gamma(D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$e^+e^- \rightarrow D^0D^-\pi^+\gamma$

 Γ_{12}/Γ

 NODE=M072R20
 NODE=M072R20

$$\Gamma(D\bar{D}^*\pi(\text{excl. } D^*\bar{D}^*))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+e^- \rightarrow D\bar{D}^*\pi$

 Γ_{13}/Γ

 NODE=M072R21
 NODE=M072R21

$$\Gamma(D^0\bar{D}^{*-}\pi^+ + \text{c.c. (excl. } D^*(2010)^+D^*(2010)^-))/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHLOVA 09	BELL	$e^+e^- \rightarrow D^0D^{*-}\pi^+\gamma$

 Γ_{14}/Γ

 NODE=M072R22
 NODE=M072R22

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

VALUE

seen

seen

seen

DOCUMENT ID

TECN

COMMENT

PAKHLOVA 11 BELL $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$ DEL-AMO-SA..10N BABR $e^+ e^- \rightarrow D_s^+ D_s^- \gamma$ CRONIN-HEN..09 CLEO $e^+ e^- \rightarrow D_s^+ D_s^-$ Γ_{15}/Γ NODE=M072R23
NODE=M072R23 $\Gamma(J/\psi \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<4 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{17}/Γ NODE=M072R01
NODE=M072R01 $\Gamma(J/\psi \pi^0 \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<2 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{18}/Γ NODE=M072R02
NODE=M072R02 $\Gamma(J/\psi \eta)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

5.2±0.5±0.5 24 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 $e^+ e^- \rightarrow$ hadrons24 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. Γ_{19}/Γ NODE=M072R03
NODE=M072R03 $\Gamma(J/\psi \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<0.28 90 25 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 $e^+ e^- \rightarrow$ hadrons25 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. Γ_{20}/Γ NODE=M072R04
NODE=M072R04 $\Gamma(J/\psi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<2 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{21}/Γ NODE=M072R05
NODE=M072R05 $\Gamma(\chi_{c1} \gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

• • • 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 Γ_{22}/Γ NODE=M072R06
NODE=M072R06 $\Gamma(\chi_{c2} \gamma)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

• • • 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 Γ_{23}/Γ NODE=M072R07
NODE=M072R07 $\Gamma(\chi_{c1} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<11 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{24}/Γ NODE=M072R08
NODE=M072R08 $\Gamma(\chi_{c2} \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<32 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{25}/Γ NODE=M072R09
NODE=M072R09 $\Gamma(h_c(1P) \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<3 90 26 PEDLAR 11 CLEO $e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$ 26 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. Γ_{26}/Γ NODE=M072R24
NODE=M072R24 $\Gamma(\phi \pi^+ \pi^-)/\Gamma_{\text{total}}$ VALUE (units 10^{-3})

CL%

DOCUMENT ID

TECN

COMMENT

<3 90 COAN 06 CLEO 3.97–4.06 $e^+ e^- \rightarrow$ hadrons Γ_{27}/Γ NODE=M072R10
NODE=M072R10

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.9	90	27 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

27 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_{29}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.9	90	28 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

28 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_{30}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	29 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

29 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_{31}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.3	90	30 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

30 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_{32}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.7	90	31 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

31 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_{33}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	32 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

32 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_{34}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.8	90	33 ABLIKIM	13Q BES3	$e^+e^- \rightarrow \psi(4040)$

33 Assuming that interference effects between resonance and continuum can be neglected.

NODE=M072R32
NODE=M072R32

NODE=M072R32;LINKAGE=A

 $\psi(4040)$ REFERENCES

NODE=M072

ABLIKIM	200	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	Ablikim M. <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.)

REFID=60344
REFID=58710
REFID=56816
REFID=55393
REFID=55377
REFID=54738
REFID=53638
REFID=16787
REFID=53532
REFID=53540
REFID=52724
REFID=53114
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

X(4050)[±]

$I^G(J^{PC}) = 1^-(?^{?+})$
I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

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=M191

NODE=M191

X(4050)[±] MASS

NODE=M191M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4051±14⁺²⁰₋₄₁	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M191M

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191M;LINKAGE=MI

X(4050)[±] WIDTH

NODE=M191W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
82⁺²¹⁺⁴⁷₋₁₇₋₂₂	¹ MIZUK	08	BELL $\bar{B}^0 \rightarrow K^-\pi^+\chi_{c1}(1P)$

NODE=M191W

¹ From a Dalitz plot analysis with two Breit-Wigner amplitudes.

NODE=M191W;LINKAGE=MI

X(4050)[±] DECAY MODES

NODE=M191215;NODE=M191

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\chi_{c1}(1P)$	seen
Γ_2 $\pi^\pm\psi(3770)$	not seen

DESIG=1

DESIG=2

X(4050)[±] BRANCHING RATIOS

NODE=M191225

$\Gamma(\pi^+\chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_1/Γ

NODE=M191R01
NODE=M191R01

VALUE	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	² LEES	12B	BABR $B \rightarrow K\pi\chi_{c1}(1P)$

NODE=M191R01;LINKAGE=MI

¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^-\chi_{c1}(1P)) \times B(X(4050)^+ \rightarrow \pi^+\chi_{c1}(1P)) = (3.0^{+1.5+3.7}_{-0.8-1.6}) \times 10^{-5}$.

² With a product branching fraction limit of $B(\bar{B}^0 \rightarrow X(4050)^+K^-) \times B(X(4050)^+ \rightarrow \chi_{c1}\pi^+) < 1.8 \times 10^{-5}$ at 90% CL.

NODE=M191R01;LINKAGE=LE

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$ Γ_2/Γ

NODE=M191R00
NODE=M191R00

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;LINKAGE=A

X(4050)[±] REFERENCES

NODE=M191

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.)

REFID=59910
REFID=54042
REFID=52535

$X(4055)^\pm$
 $I^G(J^{PC}) = 1^+(?^-)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

Needs confirmation. Seen by WANG 15A in the $\psi(2S)\pi^+\pi^-$ invariant mass distribution in $\psi(4360) \rightarrow \psi(2S)\pi^+\pi^-$ decay.

NODE=M223

NODE=M223

 $X(4055)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4054 $\pm 3 \pm 1$	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 3.5 σ .

² Statistical error only, with significance of 5.9 σ (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 9.2 σ . 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

 $X(4055)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
45 $\pm 11 \pm 6$	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 3.5 σ .

² Statistical error only, with significance of 5.9 σ (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 9.2 σ . 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

 $X(4055)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $\pi^+\psi(2S)$	seen
Γ_2 $\pi^\pm\psi(3770)$	not seen

NODE=M223215;NODE=M223

DESIG=1

DESIG=2

 $X(4055)^\pm$ BRANCHING RATIOS

$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$				Γ_1/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
seen	¹ WANG	15A	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

¹ Statistical significance of 3.5 σ .

NODE=M223225

NODE=M223R01

NODE=M223R01

NODE=M223R01;LINKAGE=A

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$	Γ_2/Γ		
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=M223R00

NODE=M223R00

NODE=M223R00;LINKAGE=A

 $X(4055)^\pm$ REFERENCES

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 (errata.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
WANG	15A	PR D91 112007	X.L. Wang <i>et al.</i>	(BELLE Collab.)

NODE=M223

REFID=59910

REFID=58896

REFID=58029

REFID=59611

REFID=56839

$X(4100)^\pm$

$$J^{PC} = 1^-(??)$$

NODE=M240

OMITTED FROM SUMMARY TABLE

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M240

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 3.4σ . $J^P = 0^+$ or 1^- assignment consistent with data.

 $X(4100)^\pm$ 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

 $X(4100)^\pm$ WIDTH

NODE=M240W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$152 \pm 58^{+60}_{-35}$	AAIJ	18AN LHCB	$B^0 \rightarrow \eta_c(1S)K^+\pi^-$

NODE=M240W

 $X(4100)^\pm$ DECAY MODES

NODE=M240215;NODE=M240

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_c(1S)\pi^-$	seen
$\Gamma_2 \quad \pi^\pm\psi(3770)$	not seen

DESIG=1

DESIG=2

 $X(4100)^\pm$ BRANCHING RATIOS

NODE=M240225

$\Gamma(\eta_c(1S)\pi^-)/\Gamma_{\text{total}}$	Γ_1/Γ		
VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	18AN LHCB	$B^0 \rightarrow \eta_c(1S)K^+\pi^-$
¹ AAIJ 18AN quotes a fit fraction for $B^0 \rightarrow X(4100)^-K^+ \rightarrow \eta_c(1S)\pi^-K^+$ of $(3.3 \pm 1.1^{+1.2}_{-1.1})\%$ from an amplitude analysis.			

NODE=M240R01
NODE=M240R01

NODE=M240R01;LINKAGE=A

$\Gamma(\pi^\pm\psi(3770))/\Gamma_{\text{total}}$	Γ_2/Γ		
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>
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

 $X(4100)^\pm$ REFERENCES

NODE=M240

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.)

REFID=59910
REFID=59335

$\chi_{c1}(4140)$

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

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.

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 $\sqrt{s} = 4.23, 4.26, 4.36$ GeV.

NODE=M193

NODE=M193

 $\chi_{c1}(4140)$ MASS

NODE=M193M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4146.8 ± 2.4 OUR AVERAGE		Error includes scale factor of 1.1.		
$4146.5 \pm 4.5^{+4.6}_{-2.8}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
$4143.4^{+2.9}_{-3.0} \pm 0.6$	19	² AALTONEN	17 CDF	$B^+ \rightarrow J/\psi \phi K^+$
$4152.5 \pm 1.7^{+6.2}_{-5.4}$	616	³ ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
$4159.0 \pm 4.3 \pm 6.6$	52	⁴ ABAZOV	14A D0	$B^+ \rightarrow J/\psi \phi K^+$
$4148.0 \pm 2.4 \pm 6.3$	0.3k	⁵ CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4143.0 \pm 2.9 \pm 1.2$	14	^{6,7} 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 8.4σ . 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 Statistical significance of 3.8σ . ⁷ Superseded by AALTONEN 17.				

NODE=M193M

NODE=M193M;LINKAGE=D
 NODE=M193M;LINKAGE=E
 NODE=M193M;LINKAGE=C
 NODE=M193M;LINKAGE=A
 NODE=M193M;LINKAGE=B
 NODE=M193M;LINKAGE=AA
 NODE=M193M;LINKAGE=F

 $\chi_{c1}(4140)$ WIDTH

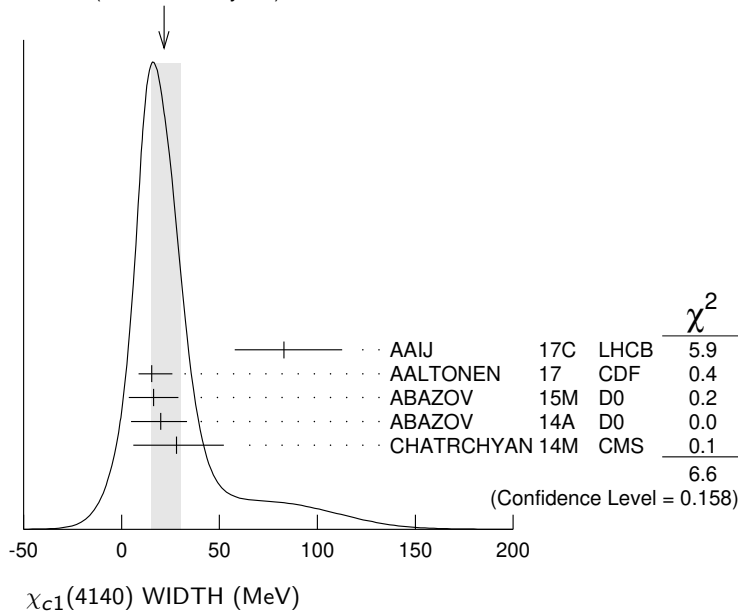
NODE=M193W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
22^{+8}_{-7} OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		
$83 \pm 21^{+21}_{-14}$	4289	¹ AAIJ	17C 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	$p\bar{p} \rightarrow J/\psi \phi + \text{anything}$
$20 \pm 13^{+3}_{-8}$	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. • • •				
$11.7^{+8.3}_{-5.0} \pm 3.7$	14	^{6,7} 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 8.4σ . 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 Statistical significance of 3.8σ . ⁷ Superseded by AALTONEN 17.				

NODE=M193W

NODE=M193W;LINKAGE=D
 NODE=M193W;LINKAGE=E
 NODE=M193W;LINKAGE=C
 NODE=M193W;LINKAGE=A
 NODE=M193W;LINKAGE=B
 NODE=M193W;LINKAGE=AA
 NODE=M193W;LINKAGE=F

WEIGHTED AVERAGE
22+8-7 (Error scaled by 1.3)



$\chi_{c1}(4140)$ DECAY MODES

NODE=M193215;NODE=M193

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	not seen

DESIG=1

DESIG=2

$\chi_{c1}(4140)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

NODE=M193220

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
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=M193G01
NODE=M193G01

OCCUR=2

NODE=M193G01;LINKAGE=S0
NODE=M193G01;LINKAGE=S2

$\chi_{c1}(4140)$ BRANCHING RATIOS

NODE=M193225

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	¹ AAIJ	17C	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. ● ● ●					
not seen		⁶ ABLIKIM	15	BES3	$e^+e^- \rightarrow \gamma\phi J/\psi$
not seen		⁷ AAIJ	12AA	LHCB	$p\bar{p} \rightarrow B^+ X$ at 7 TeV

NODE=M193R01
NODE=M193R01

- From an amplitude analysis of the decay $B^+ \rightarrow J/\psi\phi K^+$ with a significance of 8.4 σ .
- Statistical significance of more than 6 σ .
- 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.
- 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 .
- Statistical significance of 3.8 σ .
- 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.
- 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=E
NODE=M193R01;LINKAGE=D
NODE=M193R01;LINKAGE=A

NODE=M193R01;LINKAGE=C

NODE=M193R01;LINKAGE=AA
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	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=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			
4191 $^{+9}_{-8}$	AAIJ	13BC	LHCB $B^+ \rightarrow K^+ \mu^+ \mu^-$
4191.7 ± 6.5	¹ ABLIKIM	08D	BES2 $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
4193 ± 7	² MO	10	RVUE $e^+e^- \rightarrow \text{hadrons}$
4151 ± 4	³ SETH	05A	RVUE $e^+e^- \rightarrow \text{hadrons}$
4155 ± 5	⁴ SETH	05A	RVUE $e^+e^- \rightarrow \text{hadrons}$
4159 ± 20	BRANDELIK	78C	DASP e^+e^-

NODE=M025M

NODE=M025M

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.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

OCCUR=2

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
70 ± 10 OUR AVERAGE			
65 $^{+22}_{-16}$	AAIJ	13BC	LHCB $B^+ \rightarrow K^+ \mu^+ \mu^-$
71.8 ± 12.3	¹ ABLIKIM	08D	BES2 $e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
79 ± 14	² MO	10	RVUE $e^+e^- \rightarrow \text{hadrons}$
107 ± 10	³ SETH	05A	RVUE $e^+e^- \rightarrow \text{hadrons}$
107 ± 16	⁴ SETH	05A	RVUE $e^+e^- \rightarrow \text{hadrons}$
78 ± 20	BRANDELIK	78C	DASP e^+e^-

NODE=M025W

NODE=M025W

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.

³ From a fit to Crystal Ball (OSTERHELD 86) data.

⁴ From a fit to BES (BAI 02C) data.

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} $D^0D^-\pi^+ + \text{c.c. (excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.})$	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} $\phi\pi^+\pi^-$	$< 2 \times 10^{-3}$	90%	DESIG=14
Γ_{34} $\gamma\chi_{c1}(3872)$	$< 1.8 \times 10^{-3}$	90%	DESIG=44
Γ_{35} $\gamma X(3915) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.36 \times 10^{-4}$	90%	DESIG=35
Γ_{36} $\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.18 \times 10^{-4}$	90%	DESIG=36
Γ_{37} $\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-$	$< 1.47 \times 10^{-4}$	90%	DESIG=37
Γ_{38} $\gamma X(3915) \rightarrow \gamma\gamma J/\psi$	$< 1.26 \times 10^{-4}$	90%	DESIG=39
Γ_{39} $\gamma X(3930) \rightarrow \gamma\gamma J/\psi$	$< 8.8 \times 10^{-5}$	90%	DESIG=40
Γ_{40} $\gamma X(3940) \rightarrow \gamma\gamma J/\psi$	$< 1.79 \times 10^{-4}$	90%	DESIG=41
Γ_{41} K^+K^-			DESIG=42
Γ_{42} $K_S^0 K^\pm \pi^\mp$			DESIG=43

$\psi(4160)$ 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

 $\psi(4160) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$ $\Gamma(J/\psi\eta') \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{22}\Gamma_1/\Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
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=M025235

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

 $\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{42}\Gamma_1/\Gamma$

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

 $\psi(4160) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma^2(\text{total})$ $\Gamma(J/\psi\eta)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$ $\Gamma_{20}/\Gamma \times \Gamma_1/\Gamma$

VALUE (units 10^{-8})	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2.8±0.9±0.9	¹ WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$
12.8±1.7±2.0	² WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M025230

NODE=M025R32
NODE=M025R32

OCCUR=2

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.

$\psi(4160)$ BRANCHING RATIOS

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

Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	13BC LHCb	$B^+ \rightarrow K^+ \mu^+ \mu^-$

¹ AAIJ 13BC report $B(B^+ \rightarrow K^+ \psi(4160)) B(\psi(4160) \rightarrow \mu^+ \mu^-) = (3.5^{+0.9}_{-0.8}) \times 10^{-9}$.

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$

Γ_3/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
0.02 ± 0.03 ± 0.02	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

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

Γ_4/Γ

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 $e^+e^- \rightarrow D^0\bar{D}^0\gamma$

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

Γ_5/Γ

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 $e^+e^- \rightarrow D^+D^-\gamma$

$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow D^{*0}\bar{D}^0$

$\Gamma(D^*(2010)^+D^- + \text{c.c.})/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow D^{*+}D^-$

• • • 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.

$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*)$

Γ_6/Γ_9

VALUE	DOCUMENT ID	TECN	COMMENT
0.34 ± 0.14 ± 0.05	AUBERT	09M BABR	$e^+e^- \rightarrow \gamma D^{(*)}\bar{D}^{(*)}$

$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0)/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow D^{*0}\bar{D}^{*0}$

$\Gamma(D^*(2010)^+D^*(2010)^-)/\Gamma_{\text{total}}$

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 $e^+e^- \rightarrow D^{*+}D^{*-}$

• • • 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=M025R32;LINKAGE=A

NODE=M025R32;LINKAGE=B

NODE=M025225

NODE=M025R31
NODE=M025R31

NODE=M025R31;LINKAGE=A

NODE=M025R14
NODE=M025R14

NODE=M025R16
NODE=M025R16

NODE=M025R17
NODE=M025R17

NODE=M025R18
NODE=M025R18

NODE=M025R19
NODE=M025R19

NODE=M025R19;LINKAGE=A

NODE=M025R15
NODE=M025R15

NODE=M025R20
NODE=M025R20

NODE=M025R21
NODE=M025R21

NODE=M025R21;LINKAGE=A

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.})) / \Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{12}/Γ
not seen	PAKHLOVA	08A	BELL $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$	

NODE=M025R22
NODE=M025R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*)) / \Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{13}/Γ
seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D \bar{D}^* \pi$	

NODE=M025R23
NODE=M025R23

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-)) / \Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{14}/Γ
not seen	PAKHLOVA	09	BELL $e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$	

NODE=M025R24
NODE=M025R24

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

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{15}/Γ
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

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.}) / \Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{16}/Γ
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

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{17}/Γ
<3	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R01
NODE=M025R01

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{18}/Γ
<3	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R02
NODE=M025R02

$$\Gamma(J/\psi K^+ K^-) / \Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{19}/Γ
<2	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R03
NODE=M025R03

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{20}/Γ
<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

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{21}/Γ
<1	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R05
NODE=M025R05

$$\Gamma(J/\psi \eta') / \Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{22}/Γ
<5	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R06
NODE=M025R06

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{23}/Γ
<1	90	COAN	06	CLEO 4.12–4.2 $e^+ e^- \rightarrow$ hadrons	

NODE=M025R07
NODE=M025R07

$$\Gamma(\psi(2S) \pi^+ \pi^-) / \Gamma_{\text{total}}$$

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_{24}/Γ
<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

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

<7	90	COAN	06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

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	$e^+e^- \rightarrow h_c(1P)\pi^+\pi^-$

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
NODE=M025R27

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	$e^+e^- \rightarrow h_c(1P)\pi^0\pi^0$

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
NODE=M025R28

NODE=M025R28;LINKAGE=PE

 $\Gamma(h_c(1P)\eta)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	CL%	EVTS	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_{33}/Γ

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

<2	90	COAN	06	CLEO	4.12–4.2 $e^+e^- \rightarrow$ hadrons

NODE=M025R13
NODE=M025R13

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	COMMENT

<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 $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 3.6 \times 10^{-2}$.

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 $B(\chi_{c1}(3872) \rightarrow \gamma J/\psi) = 8.0 \times 10^{-3}$.

NODE=M025R43
NODE=M025R43

OCCUR=2

NODE=M025R43;LINKAGE=A

NODE=M025R43;LINKAGE=B

NODE=M025R43;LINKAGE=C

$$\Gamma(\gamma X(3915) \rightarrow \gamma J/\psi \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{35}/\Gamma$$

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

$$\Gamma(\gamma X(3930) \rightarrow \gamma J/\psi \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{36}/\Gamma$$

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

$$\Gamma(\gamma X(3940) \rightarrow \gamma J/\psi \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{37}/\Gamma$$

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

$$\Gamma(\gamma X(3915) \rightarrow \gamma \gamma J/\psi) / \Gamma_{\text{total}} \quad \Gamma_{38}/\Gamma$$

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

$$\Gamma(\gamma X(3930) \rightarrow \gamma \gamma J/\psi) / \Gamma_{\text{total}} \quad \Gamma_{39}/\Gamma$$

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

$$\Gamma(\gamma X(3940) \rightarrow \gamma \gamma J/\psi) / \Gamma_{\text{total}} \quad \Gamma_{40}/\Gamma$$

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

$$\Gamma(K^+ K^-) / \Gamma_{\text{total}} \quad \Gamma_{41}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

• • • 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
NODE=M025R33

NODE=M025R33;LINKAGE=A

$\psi(4160)$ REFERENCES

ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AE	PR D99 072005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ZHUKOVA	18	PR D97 012002	V. Zhukova <i>et al.</i>	(BELLE Collab.)
ABLIKIM	17R	PR D96 012001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
GAO	17	PR D95 092007	X.Y. Gao, C.P. Shen, C.Z. Yuan	
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)
ABLIKIM	15L	PR D91 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
DRUZHININ	15	PR D92 054024	V.P. Druzhinin	(NOVO)
HAN	15	PR D92 012011	Y.L. Han <i>et al.</i>	(BELLE Collab.)
AAIJ	13BC	PRL 111 112003	R. Aaij <i>et al.</i>	(LHCb Collab.)
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)
XIAO	13	PR D87 057501	T. Xiao <i>et al.</i>	(NWES, WAYN)
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.)

NODE=M025

REFID=60210
REFID=59856
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REFID=51064
REFID=22232

X(4160)

$I^G(J^{PC}) = ?^?(??)$

OMITTED FROM SUMMARY TABLE
Seen by PAKHLOV 08 in $e^+e^- \rightarrow J/\psi X, X \rightarrow D^*\bar{D}^*$

X(4160) MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4156^{+25}_{-20} \pm 15$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

X(4160) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$139^{+111}_{-61} \pm 21$	24	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$

X(4160) DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad D\bar{D}$	not seen
$\Gamma_2 \quad D^*\bar{D} + \text{c.c.}$	not seen
$\Gamma_3 \quad D^*\bar{D}^*$	seen

X(4160) BRANCHING RATIOS

$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*)$					Γ_1/Γ_3
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
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.22	90	PAKHLOV	08	BELL $e^+e^- \rightarrow J/\psi X$	

X(4160) REFERENCES

PAKHLOV 08 PRL 100 202001 P. Pakhlov *et al.* (BELLE Collab.)

Z_c(4200)

$I^G(J^{PC}) = 1^+(1^+ -)$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE
was $X(4200)^\pm$
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.
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.

Z_c(4200) MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4196^{+31+17}_{-29-13}	CHILIKIN 14	BELL	$\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

Z_c(4200) WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$370 \pm 70^{+70}_{-132}$	CHILIKIN 14	BELL	$\bar{B}^0 \rightarrow J/\psi K^- \pi^+$

$Z_c(4200)$ DECAY MODES

NODE=M231215;NODE=M231

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi \pi^+$	seen

DESIG=1

 $Z_c(4200)$ BRANCHING RATIOS

NODE=M231220

$\Gamma(J/\psi \pi^+)/\Gamma_{\text{total}}$				Γ_1/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
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 $B^0 \rightarrow K^+ \pi^- J/\psi + \text{c.c.}$	
¹ From a model-independent analysis.				

NODE=M231R01
NODE=M231R01

NODE=M231R01;LINKAGE=C

 $Z_c(4200)$ REFERENCES

NODE=M231

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.)

REFID=59776
REFID=56344

NODE=M222

 $\psi(4230)$

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

also known as $Y(4230)$; was $X(4230)$

NODE=M222

The recent measurement of $e^+e^- \rightarrow J/\psi \pi \pi$ (ABLIKIM 17B) led to a downward shift in the mass of the $\psi(4260)$, also known as $Y(4260)$, such that a distinction between the $\psi(4260)$ and $\psi(4230)$ no longer appears justified. Therefore, starting from this edition, we include the data of ABLIKIM 17B in this node and have listed the $\psi(4230)$ in the summary tables instead of the $\psi(4260)$.

 $\psi(4230)$ MASS

NODE=M222M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
4220 ± 15 OUR ESTIMATE				
4219.1 ± 1.9 OUR AVERAGE				Error includes scale factor of 1.1. [4218.7 ± 2.8 MeV OUR 2020 AVERAGE Scale factor = 1.3]
4220.4 ± 2.4 ± 2.3	¹	ABLIKIM	20N	BES3 $e^+e^- \rightarrow \pi^0 \pi^0 J/\psi$
4218.6 ± 3.8 ± 2.5	¹	ABLIKIM	20O	BES3 $e^+e^- \rightarrow \eta J/\psi$
4218.5 ± 1.6 ± 4.0	²	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	³	ABLIKIM	19V	BES3 $e^+e^- \rightarrow \gamma \chi_{c1}(3872)$
4222.0 ± 3.1 ± 1.4	⁴	ABLIKIM	17B	BES3 $e^+e^- \rightarrow \pi^+ \pi^- J/\psi$
4218 ^{+5.5} _{-4.5} ± 0.9		ABLIKIM	17G	BES3 $e^+e^- \rightarrow \pi^+ \pi^- h_c$
4209.5 ± 7.4 ± 1.4	⁵	ABLIKIM	17V	BES3 $e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4231.9 ± 5.3 ± 4.9		ABLIKIM	20N	BES3 $e^+e^- \rightarrow \pi^0 Z_c(3900)^0, Z_c^0 \rightarrow \pi^0 J/\psi$
4230 ± 8 ± 6	180	⁶ ABLIKIM	15C	BES3 $e^+e^- \rightarrow \omega \chi_{c0}$
¹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV. ² From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C. ³ Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+ \pi^- J/\psi$. ⁴ From a three-resonance fit. ⁵ 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} . ⁶ 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=M222M
→ UNCHECKED ←
NEW

OCCUR=2

NODE=M222M;LINKAGE=G
NODE=M222M;LINKAGE=CNODE=M222M;LINKAGE=F
NODE=M222M;LINKAGE=E
NODE=M222M;LINKAGE=B

NODE=M222M;LINKAGE=A

 $\psi(4230)$ WIDTH

NODE=M222W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

20 to 100 OUR ESTIMATE
50 ± 9 OUR AVERAGE Error includes scale factor of 3.8. See the ideogram below.
 [44 ± 9 MeV OUR 2020 AVERAGE Scale factor = 3.3]

46.2 ± 4.7 ± 2.1	¹ ABLIKIM	20N	BES3	$e^+e^- \rightarrow \pi^0\pi^0 J/\psi$
82.0 ± 5.7 ± 0.4	¹ ABLIKIM	20O	BES3	$e^+e^- \rightarrow \eta J/\psi$
28.2 ± 3.9 ± 1.6	² ABLIKIM	19AI	BES3	$e^+e^- \rightarrow \omega\chi_{c0}$
77.0 ± 6.8 ± 6.3	ABLIKIM	19R	BES3	$e^+e^- \rightarrow \pi^+ D^0 D^{*-} +$
				c.c.
115 ⁺³⁸ ₋₂₆ ± 12	³ ABLIKIM	19V	BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$
44.1 ± 4.3 ± 2.0	⁴ ABLIKIM	17B	BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
66.0 ^{+12.3} _{-8.3} ± 0.4	ABLIKIM	17G	BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$
80.1 ± 24.6 ± 2.9	⁵ ABLIKIM	17V	BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
41.2 ± 16.0 ± 16.4	ABLIKIM	20N	BES3	$e^+e^- \rightarrow \pi^0 Z_c(3900)^0,$ $Z_c^0 \rightarrow \pi^0 J/\psi$
38 ± 12 ± 2 180	⁶ ABLIKIM	15C	BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

² From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.

³ Simultaneous fit to $\chi_{c1} \rightarrow \omega J/\psi$ and $\chi_{c1} \rightarrow \pi^+\pi^- J/\psi$.

⁴ From a three-resonance fit.

⁵ 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} .

⁶ 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=M222W
 → UNCHECKED ←
 NEW

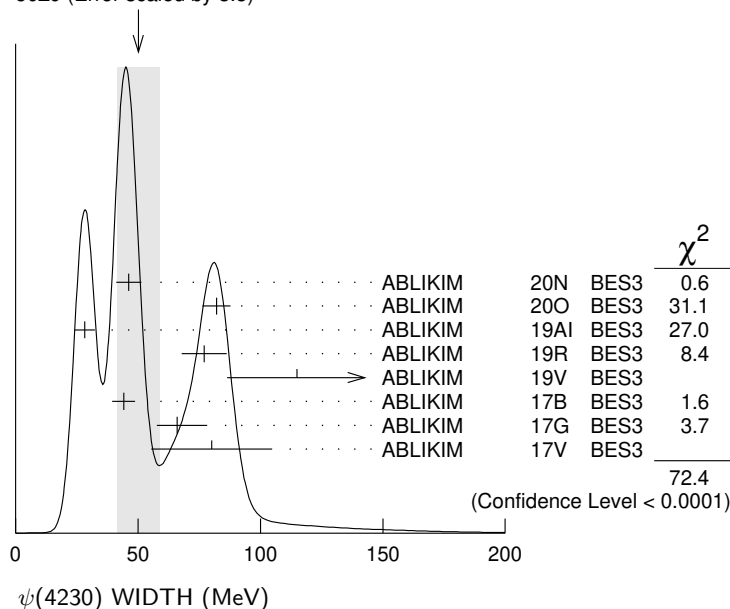
OCCUR=2

NODE=M222W;LINKAGE=F
 NODE=M222W;LINKAGE=C

NODE=M222W;LINKAGE=E
 NODE=M222W;LINKAGE=D
 NODE=M222W;LINKAGE=B

NODE=M222W;LINKAGE=A

WEIGHTED AVERAGE
 50±9 (Error scaled by 3.8)



ψ(4230) DECAY MODES

NODE=M222215;NODE=M222

Mode	Fraction (Γ_i/Γ)
Γ ₁ e^+e^-	
Γ ₂ $\omega\chi_{c0}$	seen
Γ ₃ $\pi^+\pi^- h_c$	seen
Γ ₄ $\pi^0\pi^0 J/\psi$	seen
Γ ₅ $\pi^+\pi^- J/\psi$	seen
Γ ₆ $\eta J/\psi$	seen
Γ ₇ $\pi^+\pi^- \psi(2S)$	seen
Γ ₈ $\pi^+ D^0 D^{*-} +$	seen
Γ ₉ $\Xi^- \Xi^+$	
Γ ₁₀ $\gamma\chi_{c1}(3872)$	seen

DESIG=1
 DESIG=2
 DESIG=3
 DESIG=9
 DESIG=7
 DESIG=10
 DESIG=4
 DESIG=5
 DESIG=6
 DESIG=8

$\psi(4230) \Gamma(i) \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M222220

 $\Gamma(\omega \chi_{c0}) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1 / \Gamma$

VALUE (eV)	EVTs	DOCUMENT ID	TECN	COMMENT

2.5±0.2±0.3		¹ ABLIKIM	19A BES3	$e^+ e^- \rightarrow \omega \chi_{c0}$

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

2.7±0.5±0.4	180	² ABLIKIM	15C BES3	$e^+ e^- \rightarrow \omega \chi_{c0}$

¹ From a fit of the measured cross section from $\sqrt{s} = 4.178\text{--}4.278$ GeV. Supersedes ABLIKIM 15C.² 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=M222G01;LINKAGE=B

NODE=M222G01;LINKAGE=A

 $\Gamma(\eta J/\psi) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_6 \Gamma_1 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

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

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=M222R10
NODE=M222R10

OCCUR=2

OCCUR=3

NODE=M222R10;LINKAGE=A

NODE=M222R10;LINKAGE=B

NODE=M222R10;LINKAGE=C

 $\Gamma(\pi^+ \pi^- \psi(2S)) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_1 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

1.6±1.3		¹ ABLIKIM	19K BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$

1.8±1.4		² ABLIKIM	19K BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$

¹ Solution I of two equivalent solutions in a fit using two interfering resonances.² Solution II of two equivalent solutions in a fit using two interfering resonances.NODE=M222R03
NODE=M222R03

OCCUR=2

NODE=M222R03;LINKAGE=A

NODE=M222R03;LINKAGE=B

 $\Gamma(\Xi^- \Xi^+) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_9 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<3.3 × 10 ⁻⁴	90	ABLIKIM	20C BES3	$e^+ e^- \rightarrow \Xi^- \Xi^+$

NODE=M222R05
NODE=M222R05 $\psi(4230)$ BRANCHING RATIOS

NODE=M222225

 $\Gamma(\omega \chi_{c0}) / \Gamma_{\text{total}}$ Γ_2 / 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 $\sqrt{s} = 4.21\text{--}4.42$ 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=M222R01
NODE=M222R01

NODE=M222R01;LINKAGE=A

 $\Gamma(\pi^+ \pi^- h_c) / \Gamma_{\text{total}}$ Γ_3 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen	ABLIKIM	17G BES3	$e^+ e^- \rightarrow \pi^+ \pi^- h_c$

NODE=M222R00
NODE=M222R00 $\Gamma(\pi^0 \pi^0 J/\psi) / \Gamma_{\text{total}}$ Γ_4 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen	¹ ABLIKIM	20N BES3	$e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$

¹ From a fit to the cross section $e^+ e^- \rightarrow \pi^0 \pi^0 J/\psi$ at center-of-mass energies between 3.808 and 4.600 GeV.NODE=M222R08
NODE=M222R08

NODE=M222R08;LINKAGE=A

 $\Gamma(\pi^+ \pi^- J/\psi) / \Gamma_{\text{total}}$ Γ_5 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen	ABLIKIM	17B BES3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$

NODE=M222R06
NODE=M222R06 $\Gamma(\eta J/\psi) / \Gamma_{\text{total}}$ Γ_6 / Γ

VALUE	DOCUMENT ID	TECN	COMMENT

seen	ABLIKIM	200 BES3	$e^+ e^- \rightarrow \eta J/\psi$

NODE=M222R09
NODE=M222R09

$\Gamma(\pi^+\pi^-\psi(2S))/\Gamma_{\text{total}}$

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} .

 Γ_7/Γ

NODE=M222R02
NODE=M222R02

NODE=M222R02;LINKAGE=A

 $\Gamma(\pi^+D^0D^{*-} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	ABLIKIM	19R BES3	$e^+e^- \rightarrow \pi^+D^0D^{*-} + \text{c.c.}$

 Γ_8/Γ

NODE=M222R04
NODE=M222R04

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT

seen	ABLIKIM	19V BES3	$e^+e^- \rightarrow \gamma\chi_{c1}(3872)$

 Γ_{10}/Γ

NODE=M222R07
NODE=M222R07

 $\psi(4230)$ REFERENCES

ABLIKIM	20C	PRL 124 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20N	PR D102 012009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20O	PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AI	PR D99 091103	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19K	PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19R	PRL 122 102002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19V	PRL 122 232002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17B	PRL 118 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17G	PRL 118 092002	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.)
ABLIKIM	15C	PRL 114 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)

NODE=M222

REFID=60215
REFID=60338
REFID=60344
REFID=59871
REFID=59611
REFID=59765
REFID=59796
REFID=57755
REFID=57915
REFID=58029
REFID=59611
REFID=56401

 $R_{c0}(4240)$

$I^G(J^{PC}) = 1^+(0^{--})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

was $X(4240)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M216

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.

 $R_{c0}(4240)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

$4239 \pm 18^{+45}_{-10}$	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+\pi^-\psi(2S)$

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $Z_c(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216M

NODE=M216M

NODE=M216M;LINKAGE=AA

 $R_{c0}(4240)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

$220 \pm 47^{+108}_{-74}$	¹ AAIJ	14AG LHCB	$B^0 \rightarrow K^+\pi^-\psi(2S)$

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $Z_c(4430)$ fit, with significance 6σ including systematic variations.

NODE=M216W

NODE=M216W

NODE=M216W;LINKAGE=AA

 $R_{c0}(4240)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^-\psi(2S)$	seen

NODE=M216215;NODE=M216

DESIG=1

$R_{c0}(4240)$ BRANCHING RATIOS $\Gamma(\pi^- \psi(2S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ AAIJ	14AG LHCb	$B^0 \rightarrow K^+ \pi^- \psi(2S)$

¹ From a 4-dimensional analysis when a second, lower mass resonance is allowed in the $Z_c(4430)$ fit. No partial branching fraction quoted.

NODE=M216225

 NODE=M216R01
 NODE=M216R01

NODE=M216R01;LINKAGE=AA

 $R_{c0}(4240)$ REFERENCES
 AAIJ 14AG PRL 112 222002 R. Aaij *et al.* (LHCb Collab.)

NODE=M216

REFID=55896

NODE=M192

 $X(4250)^\pm$
 $I^G(J^{PC}) = 1^-(?^{?+})$
 I, G, C need confirmation.

OMITTED FROM SUMMARY TABLE

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M192

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.

 $X(4250)^\pm$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$4248^{+44+180}_{-29-35}$	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

NODE=M192M

NODE=M192M;LINKAGE=MI

 $X(4250)^\pm$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$177^{+54+316}_{-39-61}$	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

NODE=M192W

NODE=M192W;LINKAGE=MI

 $X(4250)^\pm$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+ \chi_{c1}(1P)$	seen

NODE=M192215;NODE=M192

DESIG=1

 $X(4250)^\pm$ BRANCHING RATIOS $\Gamma(\pi^+ \chi_{c1}(1P))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	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 ² LEES 12B BABR $B \rightarrow K \pi \chi_{c1}(1P)$

¹ With a product branching fraction measurement of $B(\bar{B}^0 \rightarrow K^- X(4250)^+) \times B(X(4250)^+ \rightarrow \pi^+ \chi_{c1}(1P)) = (4.0^{+2.3+19.7}_{-0.9-0.5}) \times 10^{-5}$.

² With a product branching fraction limit of $B(\bar{B}^0 \rightarrow X(4250)^+ K^-) \times B(X(4250)^+ \rightarrow \chi_{c1} \pi^+) < 4.0 \times 10^{-5}$ at 90% CL.

NODE=M192225

 NODE=M192R01
 NODE=M192R01

NODE=M192R01;LINKAGE=MI

NODE=M192R01;LINKAGE=LE

 $X(4250)^\pm$ REFERENCES
 LEES 12B PR D85 052003 J.P. Lees *et al.* (BABAR Collab.)
 MIZUK 08 PR D78 072004 R. Mizuk *et al.* (BELLE Collab.)

NODE=M192

 REFID=54042
 REFID=52535

NODE=M074

 $\psi(4260)$

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

OMITTED FROM SUMMARY TABLE

also known as $Y(4260)$; was $X(4260)$

The state $\psi(4260)$ received its mass label from a Breit-Wigner (BW) fit to the $J/\psi\pi\pi$ data listed below. The symmetric BW placed the mass unavoidably into the center of the distribution. The most recent measurement in the 4260 MeV mass range in the same channel (ABLIKIM 17B), however, revealed that the distribution is asymmetric and that the state has a much lower mass consistent with the entry for particle $\psi(4230)$. Thus, in this edition we merged the measurement of ABLIKIM 17B with the $\psi(4230)$ node and labeled the older measurements of this node as not used. For details see the review on "Spectroscopy of mesons containing two heavy quarks."

NODE=M074

 $\psi(4260)$ MASS

NODE=M074M

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4209.1 \pm 6.8 \pm 7.0$		¹ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
$4223.3 \pm 1.6 \pm 2.5$		² ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$ or $\psi(2S)$
$4258.6 \pm 8.3 \pm 12.1$		³ LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$4245 \pm 5 \pm 4$		⁴ LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$4247 \pm 12 \pm 17 \pm 32$		^{3,5} YUAN	07 BELL	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$4284 \pm 17 \pm 16 \pm 413.6$		HE	06B CLEO	$9.4-10.6 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$4259 \pm 8 \pm 2 \pm 125$		⁶ AUBERT,B	05I BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$

NODE=M074M

OCCUR=2

¹ From a three-resonance fit.² 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.³ From a two-resonance fit.⁴ From a single-resonance fit. Supersedes AUBERT,B 05I.⁵ Superseded by LIU 13B.⁶ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074M;LINKAGE=D

NODE=M074M;LINKAGE=C

NODE=M074M;LINKAGE=YU

NODE=M074M;LINKAGE=LE

NODE=M074M;LINKAGE=YN

NODE=M074M;LINKAGE=AU

 $\psi(4260)$ WIDTH

NODE=M074W

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$76.6 \pm 14.2 \pm 2.4$		¹ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
$54.2 \pm 2.6 \pm 1.0$		² ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$ or $\psi(2S)$
$134.1 \pm 16.4 \pm 5.5$		³ LIU	13B BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$114 \pm 16 \pm 15 \pm 7$		⁴ LEES	12AC BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$108 \pm 19 \pm 10$		^{3,5} YUAN	07 BELL	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$73 \pm 39 \pm 25 \pm 5 \pm 13.6$		HE	06B CLEO	$9.4-10.6 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$
$88 \pm 23 \pm 6 \pm 4 \pm 125$		⁶ AUBERT,B	05I BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-J/\psi$

NODE=M074W

¹ From a three-resonance fit.² 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.³ From a two-resonance fit.⁴ From a single-resonance fit. Supersedes AUBERT,B 05I.⁵ Superseded by LIU 13B.⁶ From a single-resonance fit. Two interfering resonances are not excluded. Superseded by LEES 12AC.

NODE=M074W;LINKAGE=C

NODE=M074W;LINKAGE=B

NODE=M074W;LINKAGE=YU

NODE=M074W;LINKAGE=LE

NODE=M074W;LINKAGE=YN

NODE=M074W;LINKAGE=AU

$\psi(4260)$ DECAY MODES

NODE=M074215;NODE=M074

Mode	Fraction (Γ_i/Γ)	
Γ_1 $e^+ e^-$		DESIG=1
Γ_2 $J/\psi \pi^+ \pi^-$	seen	DESIG=2;OUR EVAL;→ UNCHECKED ←
Γ_3 $J/\psi f_0(980), f_0(980) \rightarrow \pi^+ \pi^-$	seen	DESIG=41;OUR EVAL;→ UNCHECKED ←
Γ_4 $Z_c(3900)^\pm \pi^\mp, Z_c^\pm \rightarrow J/\psi \pi^\pm$	seen	DESIG=43;OUR EVAL;→ UNCHECKED ←
Γ_5 $J/\psi \pi^0 \pi^0$	seen	DESIG=4;OUR EVAL;→ UNCHECKED ←
Γ_6 $J/\psi K^+ K^-$	seen	DESIG=5;OUR EVAL;→ UNCHECKED ←
Γ_7 $J/\psi K_S^0 K_S^0$	not seen	DESIG=44
Γ_8 $J/\psi \eta$	not seen	DESIG=6;OUR EVAL;→ UNCHECKED ←
Γ_9 $J/\psi \pi^0$	not seen	DESIG=7;OUR EVAL;→ UNCHECKED ←
Γ_{10} $J/\psi \eta'$	not seen	DESIG=8;OUR EVAL;→ UNCHECKED ←
Γ_{11} $J/\psi \pi^+ \pi^- \pi^0$	not seen	DESIG=9;OUR EVAL;→ UNCHECKED ←
Γ_{12} $J/\psi \eta \pi^0$	not seen	DESIG=45
Γ_{13} $J/\psi \eta \eta$	not seen	DESIG=10;OUR EVAL;→ UNCHECKED ←
Γ_{14} $\psi(2S) \pi^+ \pi^-$	not seen	DESIG=11;OUR EVAL;→ UNCHECKED ←
Γ_{15} $\psi(2S) \eta$	not seen	DESIG=12;OUR EVAL;→ UNCHECKED ←
Γ_{16} $\chi_{c0} \omega$	not seen	DESIG=13;OUR EVAL;→ UNCHECKED ←
Γ_{17} $\chi_{c1} \pi^+ \pi^- \pi^0$	not seen	DESIG=16;OUR EVAL;→ UNCHECKED ←
Γ_{18} $\chi_{c2} \pi^+ \pi^- \pi^0$	not seen	DESIG=17;OUR EVAL;→ UNCHECKED ←
Γ_{19} $h_c(1P) \pi^+ \pi^-$	not seen	DESIG=40;OUR EVAL;→ UNCHECKED ←
Γ_{20} $\phi \pi^+ \pi^-$	not seen	DESIG=18;OUR EVAL;→ UNCHECKED ←
Γ_{21} $\phi f_0(980) \rightarrow \phi \pi^+ \pi^-$	not seen	DESIG=22;OUR EVAL;→ UNCHECKED ←
Γ_{22} $D \bar{D}$	not seen	DESIG=19;OUR EVAL;→ UNCHECKED ←
Γ_{23} $D^0 \bar{D}^0$	not seen	DESIG=31
Γ_{24} $D^+ D^-$	not seen	DESIG=32
Γ_{25} $D^* \bar{D} + c.c.$	not seen	DESIG=23;OUR EVAL;→ UNCHECKED ←
Γ_{26} $D^*(2007)^0 \bar{D}^0 + c.c.$	not seen	DESIG=33
Γ_{27} $D^*(2010)^+ D^- + c.c.$	not seen	DESIG=34
Γ_{28} $D^* \bar{D}^*$	not seen	DESIG=24;OUR EVAL;→ UNCHECKED ←
Γ_{29} $D^*(2007)^0 \bar{D}^*(2007)^0$	not seen	DESIG=35
Γ_{30} $D^*(2010)^+ D^*(2010)^-$	not seen	DESIG=36
Γ_{31} $D \bar{D} \pi + c.c.$		DESIG=37
Γ_{32} $D^0 D^- \pi^+ + c.c. \text{ (excl. } D^*(2007)^0 \bar{D}^{*0} + c.c., D^*(2010)^+ D^- + c.c.)$	not seen	DESIG=38
Γ_{33} $D \bar{D}^* \pi + c.c. \text{ (excl. } D^* \bar{D}^*)$	not seen	DESIG=25
Γ_{34} $D^0 D^{*-} \pi^+ + c.c. \text{ (excl. } D^*(2010)^+ D^*(2010)^-)$	not seen	DESIG=39
Γ_{35} $D^0 D^*(2010)^- \pi^+ + c.c.$	not seen	DESIG=30;OUR EVAL;→ UNCHECKED ←
Γ_{36} $D_1(2420) \bar{D} + c.c.$	not seen	DESIG=50
Γ_{37} $D^* \bar{D}^* \pi$	not seen	DESIG=26
Γ_{38} $D_s^+ D_s^-$	not seen	DESIG=27
Γ_{39} $D_s^{*+} D_s^- + c.c.$	not seen	DESIG=28
Γ_{40} $D_s^{*+} D_s^{*-}$	not seen	DESIG=29
Γ_{41} $p \bar{p}$	not seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ_{42} $p \bar{p} \pi^0$	not seen	DESIG=46;OUR EVAL;→ UNCHECKED ←
Γ_{43} $\Xi^- \Xi^+$		DESIG=51
Γ_{44} $K_S^0 K^\pm \pi^\mp$	not seen	DESIG=20;OUR EVAL;→ UNCHECKED ←
Γ_{45} $K_S^0 K^\pm \pi^\mp \pi^0$		DESIG=48
Γ_{46} $K_S^0 K^\pm \pi^\mp \eta$		DESIG=49
Γ_{47} $K^+ K^- \pi^0$	not seen	DESIG=21;OUR EVAL;→ UNCHECKED ←
Radiative decays		
Γ_{48} $\eta_c(1S) \gamma$	possibly seen	NODE=M074;CLUMP=C DESIG=47
Γ_{49} $\chi_{c1} \gamma$	not seen	DESIG=14;OUR EVAL;→ UNCHECKED ←
Γ_{50} $\chi_{c2} \gamma$	not seen	DESIG=15;OUR EVAL;→ UNCHECKED ←
Γ_{51} $\chi_{c1}(3872) \gamma$	seen	DESIG=42

$\psi(4260) \Gamma(i) \times \Gamma(e^+ e^-) / \Gamma(\text{total})$

NODE=M074230

 $\Gamma(J/\psi \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_1 / \Gamma$

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

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
NODE=M074G1

OCCUR=2

OCCUR=2

NODE=M074G1;LINKAGE=LE
NODE=M074G1;LINKAGE=YU
NODE=M074G1;LINKAGE=YA
NODE=M074G1;LINKAGE=YN
NODE=M074G1;LINKAGE=AU $\Gamma(J/\psi K^+ K^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_6 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<1.7	90	¹ SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

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

<1.2	90	² YUAN	08 BELL	$e^+ e^- \rightarrow \gamma K^+ K^- J/\psi$

¹ 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 2.2 and 2.3 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 2.5 GeV.² 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
NODE=M074G3

NODE=M074G3;LINKAGE=A

NODE=M074G3;LINKAGE=YU

 $\Gamma(J/\psi K_S^0 K_S^0) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_7 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.85	90	¹ SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

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.NODE=M074G02
NODE=M074G02

NODE=M074G02;LINKAGE=A

 $\Gamma(J/\psi \eta) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_8 \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

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

<14.2	90	WANG	13B BELL	$e^+ e^- \rightarrow J/\psi \eta \gamma$

NODE=M074G01
NODE=M074G01 $\Gamma(J/\psi \eta') \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{10} \Gamma_1 / \Gamma$

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 $\Gamma(\psi(2S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$ $\Gamma_{14} \Gamma_1 / \Gamma$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

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

<4.3	90	¹ LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$
7.4 ^{+2.1} _{-1.7}		² LIU	08H RVUE	10.58 $e^+ e^- \rightarrow \psi(2S) \pi^+ \pi^- \gamma$

¹ For constructive interference with the $\psi(4360)$ in a combined fit of AUBERT 07S and WANG 07D data with three resonances.² 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

NODE=M074G7;LINKAGE=LI

NODE=M074G7;LINKAGE=LU

$$\Gamma(\phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{20}\Gamma_1/\Gamma$$

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

$$\Gamma(\phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.28	90	¹ AUBERT 07AK	BABR	10.6 $e^+e^- \rightarrow \pi^+\pi^-K^+K^-\gamma$

NODE=M074G6
NODE=M074G6

¹ AUBERT 07AK reports $[\Gamma(\psi(4260) \rightarrow \phi f_0(980) \rightarrow \phi\pi^+\pi^-) \times \Gamma(\psi(4260) \rightarrow e^+e^-)/\Gamma_{\text{total}}] \times [B(\phi(1020) \rightarrow K^+K^-)] < 0.14$ eV which we divide by our best value $B(\phi(1020) \rightarrow K^+K^-) = 49.2 \times 10^{-2}$.

NODE=M074G6;LINKAGE=AU

$$\Gamma(\Xi^-\Xi^+) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{43}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.7 $\times 10^{-4}$	90	ABLIKIM	20C	BES3 $e^+e^- \rightarrow \Xi^-\Xi^+$

NODE=M074R35
NODE=M074R35

$$\Gamma(K_S^0 K^\pm \pi^\mp) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{44}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	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 at 90% 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.

NODE=M074G4;LINKAGE=A

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=B

$$\Gamma(K_S^0 K^\pm \pi^\mp \pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{45}\Gamma_1/\Gamma$$

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

$$\Gamma(K_S^0 K^\pm \pi^\mp \eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{46}\Gamma_1/\Gamma$$

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

$$\Gamma(K^+K^-\pi^0) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{47}\Gamma_1/\Gamma$$

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

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{49}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<1.4	90	¹ HAN	15	BELL 10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$

NODE=M074G03
NODE=M074G03

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G03;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{50}\Gamma_1/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<4.0	90	¹ HAN	15	BELL 10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$

NODE=M074G04
NODE=M074G04

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

NODE=M074G04;LINKAGE=A

$\psi(4260)$ BRANCHING RATIOS

NODE=M074225

$$\Gamma(J/\psi f_0(980), f_0(980) \rightarrow \pi^+\pi^-)/\Gamma(J/\psi \pi^+\pi^-) \quad \Gamma_3/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT

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

0.17 ± 0.13	¹ LEES	12AC	BABR 10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- J/\psi$

NODE=M074R02
NODE=M074R02

¹ Systematic uncertainties not estimated.

NODE=M074R02;LINKAGE=LE

$$\Gamma(Z_c(3900)^\pm \pi^\mp, Z_c^\pm \rightarrow J/\psi \pi^\pm)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_4/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.215 ± 0.033 ± 0.075	¹ ABLIKIM	13T BES3	$e^+ e^- \rightarrow \pi^+ \pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.29 ± 0.08	² LIU	13B BELL	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- J/\psi$

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=M074R01

NODE=M074R01;LINKAGE=AB
NODE=M074R01;LINKAGE=A

$$\Gamma(J/\psi K_S^0 K_S^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	SHEN	14 BELL	9.4–10.9 $e^+ e^- \rightarrow \gamma K_S^0 K_S^0 J/\psi$

NODE=M074R27
NODE=M074R27

$$\Gamma(J/\psi \eta \pi^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	ABLIKIM	15Q BES3	4.0–4.6 $e^+ e^- \rightarrow J/\psi \eta \pi^0$

NODE=M074R28
NODE=M074R28

$$\Gamma(\psi(2S) \pi^+ \pi^-)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{14}/\Gamma_2$$

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
(0.11 ± 0.03 ± 0.03) to (0.55 ± 0.18 ± 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

$$\Gamma(h_c(1P) \pi^+ \pi^-)/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{19}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ PEDLAR	11 CLEO	$e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-$

¹ At $\sqrt{s} = 4260$ MeV, PEDLAR 11 measures $\sigma(e^+ e^- \rightarrow h_c(1P) \pi^+ \pi^-) = 32 \pm 17 \pm 6 \pm 6$ 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

$$\Gamma(D\bar{D})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{22}/\Gamma_2$$

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 ± 10 MeV for the mass and 88 ± 24 MeV for the width of $\psi(4260)$.

NODE=M074R2
NODE=M074R2

NODE=M074R2;LINKAGE=AU

$$\Gamma(D^0 \bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_{23}/\Gamma$$

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

$$\Gamma(D^+ D^-)/\Gamma_{\text{total}} \quad \Gamma_{24}/\Gamma$$

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

$$\Gamma(D^* \bar{D} + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-) \quad \Gamma_{25}/\Gamma_2$$

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

$$\Gamma(D^*(2007)^0 \bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{26}/\Gamma$$

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

$$\Gamma(D^*(2010)^+ D^- + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{27}/\Gamma$$

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

$$\Gamma(D^* \bar{D}^*)/\Gamma(J/\psi \pi^+ \pi^-)$$

$$\Gamma_{28}/\Gamma_2$$

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

$$\Gamma(D^*(2007)^0 \bar{D}^*(2007)^0)/\Gamma_{\text{total}}$$

$$\Gamma_{29}/\Gamma$$

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

$$\Gamma(D^*(2010)^+ D^*(2010)^-)/\Gamma_{\text{total}}$$

$$\Gamma_{30}/\Gamma$$

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

$$\Gamma(D^0 D^- \pi^+ + \text{c.c. (excl. } D^*(2007)^0 \bar{D}^{*0} + \text{c.c., } D^*(2010)^+ D^- + \text{c.c.}))/\Gamma_{\text{total}}$$

$$\Gamma_{32}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 08A	BELL	$10.6 e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$

NODE=M074R16
NODE=M074R16

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma_{\text{total}}$$

$$\Gamma_{33}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D} \pi$

NODE=M074R22
NODE=M074R22

$$\Gamma(D \bar{D}^* \pi + \text{c.c. (excl. } D^* \bar{D}^*))/\Gamma(J/\psi \pi^+ \pi^-)$$

$$\Gamma_{33}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<15	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R05
NODE=M074R05

$$\Gamma(D^0 D^{*-} \pi^+ + \text{c.c. (excl. } D^*(2010)^+ D^*(2010)^-))/\Gamma_{\text{total}}$$

$$\Gamma_{34}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+ \gamma$

NODE=M074R23
NODE=M074R23

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma(J/\psi \pi^+ \pi^-)$$

$$\Gamma_{35}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R10
NODE=M074R10

$$\Gamma(D^0 D^*(2010)^- \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$$

$$\Gamma_{35}/\Gamma \times \Gamma_1/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.42 × 10 ⁻⁶	90	¹ PAKHLOVA 09	BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$

NODE=M074R11
NODE=M074R11

¹ Using 4263⁺⁸₋₉ MeV for the mass of $\psi(4260)$.

NODE=M074R11;LINKAGE=PA

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma_{\text{total}}$$

$$\Gamma_{37}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	CRONIN-HEN..09	CLEO	$e^+ e^- \rightarrow D^* \bar{D}^* \pi$

NODE=M074R24
NODE=M074R24

$$\Gamma(D^* \bar{D}^* \pi)/\Gamma(J/\psi \pi^+ \pi^-)$$

$$\Gamma_{37}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8.2	90	CRONIN-HEN..09	CLEO	$e^+ e^-$

NODE=M074R06
NODE=M074R06

$$\Gamma(D_1(2420)\bar{D} + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{36}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^- D\bar{D}$
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
NODE=M074R33

NODE=M074R33;LINKAGE=A

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

$$\Gamma_{38}/\Gamma$$

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

$$\Gamma(D_s^+ D_s^-)/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_{38}/\Gamma_2$$

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

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}$$

$$\Gamma_{39}/\Gamma$$

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

$$\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_{39}/\Gamma_2$$

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

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

$$\Gamma_{40}/\Gamma$$

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

$$\Gamma(D_s^{*+} D_s^{*-})/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_{40}/\Gamma_2$$

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

$$\Gamma(p\bar{p})/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_{41}/\Gamma_2$$

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

$$\Gamma(p\bar{p}\pi^0)/\Gamma(J/\psi\pi^+\pi^-)$$

$$\Gamma_{42}/\Gamma_2$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2 × 10 ⁻⁴	90	ABLIKIM	17F BES3	$e^+e^- \rightarrow \psi(4260) \rightarrow \text{hadrons}$

NODE=M074R00
NODE=M074R00
OCCUR=2

Radiative decays

$$\Gamma(\eta_c(1S)\gamma)/\Gamma_{\text{total}}$$

$$\Gamma_{48}/\Gamma$$

VALUE	DOCUMENT ID	COMMENT
possibly seen	¹ ABLIKIM	17W $e^+e^- \rightarrow \gamma\eta_c(1S)$

NODE=M074310

NODE=M074R29
NODE=M074R29

¹ 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

$\Gamma(\chi_{c1}(3872)\gamma)/\Gamma_{\text{total}}$					Γ_{51}/Γ
VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	
seen	20 $\pm$ 5	ABLIKIM	14	BES3	$e^+e^- \rightarrow J/\psi \pi^+ \pi^- \gamma$

NODE=M074R26
NODE=M074R26

$\psi(4260)$ REFERENCES

NODE=M074

ABLIKIM	20A	PR D101 012008	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60210
ABLIKIM	20C	PRL 124 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=60215
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	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
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	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	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.)	REFID=55944
ABLIKIM	13T	PRL 110 252001	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=55409
LIU	13B	PRL 110 252002	Z.Q. Liu <i>et al.</i>	(BELLE Collab.)	REFID=55410
WANG	13B	PR D87 051101	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=55377
LEES	12AC	PR D86 051102	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=54750
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
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
AUBERT	08S	PR D77 092002	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52242
LIU	08H	PR D78 014032	Z.Q. Liu, X.S. Qin, C.Z. Yuan		REFID=52296
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
YUAN	08	PR D77 011105	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=52135
AUBERT	07AK	PR D76 012008	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51908
AUBERT	07BE	PR D76 111105	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52074
AUBERT	07S	PRL 98 212001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51724
PAKHLOVA	07	PRL 98 092001	G. Pakhlova <i>et al.</i>	(BELLE Collab.)	REFID=51628
WANG	07D	PRL 99 142002	X.L. Wang <i>et al.</i>	(BELLE Collab.)	REFID=51959
YUAN	07	PRL 99 182004	C.Z. Yuan <i>et al.</i>	(BELLE Collab.)	REFID=51960
AUBERT	06B	PR D73 012005	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51026
AUBERT,BE	06D	PR D74 091103	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=51511
HE	06B	PR D74 091104	Q. He <i>et al.</i>	(CLEO Collab.)	REFID=51523
AUBERT,B	05I	PRL 95 142001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=50776

$\chi_{c1}(4274)$

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

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.

Seen by AAIJ 17C in $B^+ \rightarrow \chi_{c1} K^+$, $\chi_{c1} \rightarrow J/\psi \phi$ using an amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 6.0σ .

NODE=M233

NODE=M233

$\chi_{c1}(4274)$ MASS

NODE=M233M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4274 ± 8 -6 OUR AVERAGE				
4273.3 $\pm 8.3^{+17.2}_{-3.6}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
4274.4 $\pm 8.4^{+8.4}_{-6.7} \pm 1.9$	22	² AALTONEN	17 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 6.0σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1σ .				

NODE=M233M

NODE=M233M;LINKAGE=A
NODE=M233M;LINKAGE=B

$\chi_{c1}(4274)$ WIDTH

NODE=M233W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
49 ± 12 OUR AVERAGE				
56 $\pm 11^{+8}_{-11}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$
32.3 $\pm 21.9^{+21.9}_{-15.3} \pm 7.6$	22	² AALTONEN	17 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 6.0σ .				
² From a fit to the invariant mass spectrum with a significance of 3.1σ .				

NODE=M233W

NODE=M233W;LINKAGE=A
NODE=M233W;LINKAGE=B

$\chi_{c1}(4274)$ 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	4289	¹ 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 6.0σ .					

NODE=M233R01
NODE=M233R01

NODE=M233R01;LINKAGE=A

$\chi_{c1}(4274)$ REFERENCES

NODE=M233

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=57657
REFID=57636
REFID=58161

X(4350)

$$J^{PC} = 0^{+}(??^{+})$$

OMITTED FROM SUMMARY TABLE

Seen by SHEN 10 in the $\gamma\gamma \rightarrow J/\psi\phi$. Needs confirmation.**X(4350) MASS**

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 .				

X(4350) WIDTH

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 .				

X(4350) DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $J/\psi\phi$	seen
Γ_2 $\gamma\gamma$	seen

X(4350) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
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 $3.2\ \sigma$.					
² For $J^P = 2^+$. Statistical significance of $3.2\ \sigma$.					

X(4350) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$	Γ_1/Γ			
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
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			
<i>VALUE</i>	<i>DOCUMENT ID</i>	<i>TECN</i>	<i>COMMENT</i>	
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.)

NODE=M194

NODE=M194

NODE=M194M

NODE=M194M

NODE=M194M;LINKAGE=SH

NODE=M194W

NODE=M194W

NODE=M194W;LINKAGE=SH

NODE=M194215;NODE=M194

DESIG=1

DESIG=2

NODE=M194220

NODE=M194G01
NODE=M194G01

OCCUR=2

NODE=M194G01;LINKAGE=S0
NODE=M194G01;LINKAGE=S2

NODE=M194225

NODE=M194R01
NODE=M194R01

NODE=M194R01;LINKAGE=SH

NODE=M194R02
NODE=M194R02

NODE=M194R02;LINKAGE=SH

NODE=M194

REFID=53235

$\psi(4360)$

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

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."

NODE=M181

NODE=M181

 $\psi(4360)$ MASS

NODE=M181M

NODE=M181M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4368 ± 13 OUR AVERAGE		Error includes scale factor of 3.7. See the ideogram below.		
4320.0 ± 10.4 ± 7.0		¹ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$
4383.8 ± 4.2 ± 0.8		² ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4347 ± 6 ± 3	279	³ WANG	15A BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4340 ± 16 ± 9	37	⁴ 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. • • •				
4383.7 ± 2.9 ± 6.2		⁵ ZHANG	17B RVUE	$e^+e^- \rightarrow \pi^+\pi^- \psi(2S)$
4386.4 ± 2.1 ± 6.4		⁶ ZHANG	17C RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4355 $^{+9}_{-10}$ ± 9	74	⁷ LIU	08H RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4324 ± 24		⁸ AUBERT	07S BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$
4361 ± 9 ± 9	47	⁴ WANG	07D BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^- \psi(2S)$

¹ From a three-resonance fit.

² 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} .

³ From a two-resonance fit. Supersedes WANG 07D.

⁴ From a two-resonance fit.

⁵ From a three-resonance fit.

⁶ 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.

⁷ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.

⁸ From a single-resonance fit. Systematic errors not estimated.

NODE=M181M;LINKAGE=B

NODE=M181M;LINKAGE=C

NODE=M181M;LINKAGE=A

NODE=M181M;LINKAGE=WA

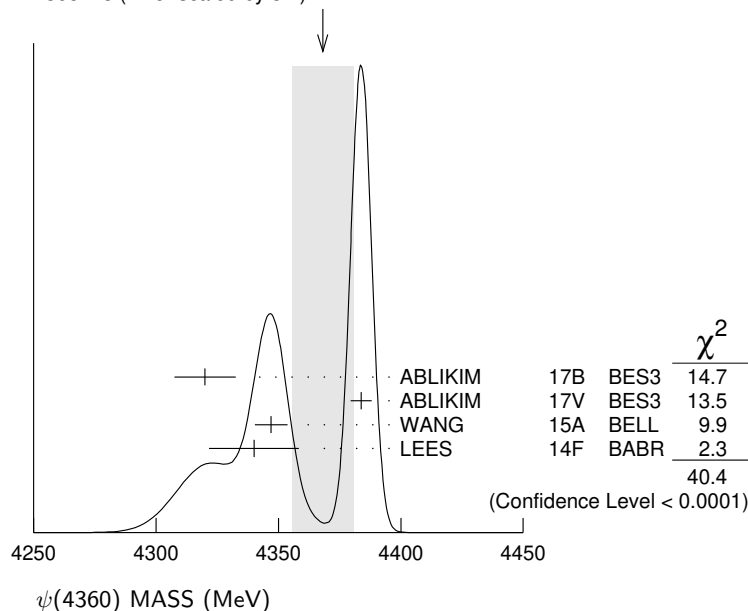
NODE=M181M;LINKAGE=E

NODE=M181M;LINKAGE=D

NODE=M181M;LINKAGE=LI

NODE=M181M;LINKAGE=AU

WEIGHTED AVERAGE
4368 ± 13 (Error scaled by 3.7)

 **$\psi(4360)$ WIDTH**

NODE=M181W

NODE=M181W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
96 ± 7 OUR AVERAGE				
101.4 $^{+25.3}_{-19.7}$ ± 10.2		¹ ABLIKIM	17B BES3	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$

84.2±12.5± 2.1	2	ABLIKIM	17V	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
103 ± 9 ± 5 279	3	WANG	15A	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
94 ±32 ±13 37	4	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. • • •					
94.2± 7.3± 2.0	5	ZHANG	17B	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
96.0± 6.7± 2.7	6	ZHANG	17C	RVUE	$e^+e^- \rightarrow \pi^+\pi^-J/\psi$ or $\psi(2S)$
103 $\begin{smallmatrix} +17 \\ -15 \end{smallmatrix}$ ±11 74	7	LIU	08H	RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
172 ±33	8	AUBERT	07S	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
74 ±15 ±10 47	4	WANG	07D	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
¹ From a three-resonance fit. ² 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 . ³ From a two-resonance fit. Supersedes WANG 07D. ⁴ From a two-resonance fit. ⁵ From a three-resonance fit. ⁶ 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. ⁷ From a combined fit of AUBERT 07S and WANG 07D data with two resonances. ⁸ From a single-resonance fit. Systematic errors not estimated.					

NODE=M181W;LINKAGE=B
 NODE=M181W;LINKAGE=C

NODE=M181W;LINKAGE=A
 NODE=M181W;LINKAGE=WA
 NODE=M181W;LINKAGE=E
 NODE=M181W;LINKAGE=D

NODE=M181W;LINKAGE=LI
 NODE=M181W;LINKAGE=AU

$\psi(4360)$ DECAY MODES

NODE=M181215;NODE=M181

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $J/\psi\pi^+\pi^-$	
Γ_3 $\psi(2S)\pi^+\pi^-$	seen
Γ_4 $\psi_2(3823)\pi^+\pi^-$	possibly seen
Γ_5 $J/\psi\eta$	
Γ_6 $D^0D^{*-}\pi^+$	
Γ_7 $D_1(2420)\bar{D} + \text{c.c.}$	possibly seen
Γ_8 $\chi_{c1}\gamma$	
Γ_9 $\chi_{c2}\gamma$	

DESIG=1
 DESIG=8
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=5
 DESIG=4
 DESIG=3
 DESIG=10
 DESIG=6
 DESIG=7

$\psi(4360) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M181230

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.3±2.8		1 ABLIKIM	19K	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
11.0±3.8		2 ABLIKIM	19K	BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
9.2±0.6±0.6 279		3 WANG	15A	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.9±0.6±0.7 279		4 WANG	15A	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
6.0±1.0±0.5 37		1 LEES	14F	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
7.2±1.0±0.6 37		2 LEES	14F	BABR	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.1 $\begin{smallmatrix} +1.3 \\ -1.2 \end{smallmatrix}$ 74		5 LIU	08H	RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
12.3±1.2 74		6 LIU	08H	RVUE	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
10.4±1.7±1.5 47		1 WANG	07D	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
11.8±1.8±1.4 47		2 WANG	07D	BELL	10.58 $e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

- ¹ Solution I of two equivalent solutions in a fit using two interfering resonances.
² Solution II of two equivalent solutions in a fit using two interfering resonances.
³ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
⁴ Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.
⁵ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.
⁶ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.

NODE=M181G1;LINKAGE=WA
 NODE=M181G1;LINKAGE=WN
 NODE=M181G1;LINKAGE=A

NODE=M181G1;LINKAGE=B

NODE=M181G1;LINKAGE=LI
 NODE=M181G1;LINKAGE=LU

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_5\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<6.8		90	WANG	13B	BELL $e^+e^- \rightarrow J/\psi\eta\gamma$

NODE=M181G01
 NODE=M181G01

$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_8\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.57	90	¹ HAN	15	BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$
¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.					

NODE=M181G02
NODE=M181G02

NODE=M181G02;LINKAGE=A

$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_9\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.9	90	¹ HAN	15	BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$
¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.					

NODE=M181G03
NODE=M181G03

NODE=M181G03;LINKAGE=A

$\psi(4360)$ BRANCHING RATIOS

NODE=M181225

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma(\psi(2S)\pi^+\pi^-)$					Γ_6/Γ_3
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<8	90	PAKHOVA	09	BELL	$e^+e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-} \pi^+$

NODE=M181R01
NODE=M181R01

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$				Γ_3/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=M181R00
NODE=M181R00

NODE=M181R00;LINKAGE=A

$\Gamma(\psi(2S)\pi^+\pi^-)/\Gamma(J/\psi\pi^+\pi^-)$				Γ_3/Γ_2
VALUE	DOCUMENT ID	TECN	COMMENT	
• • • We do not use the following data for averages, fits, limits, etc. • • • (0.81 ± 0.12 ± 0.13) to (42 ± 15 ± 15)	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=M181R04
NODE=M181R04

NODE=M181R04;LINKAGE=A

$\Gamma(\psi_2(3823)\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_4/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
possibly seen	19	¹ ABLIKIM	15S	BES3	$e^+e^- \rightarrow \pi^+\pi^-\chi_{c1}\gamma$
¹ 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
NODE=M181R03

NODE=M181R03;LINKAGE=A

$\Gamma(D^0 D^{*-} \pi^+)/\Gamma_{\text{total}} \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$					$\Gamma_6/\Gamma \times \Gamma_1/\Gamma$
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.72 × 10⁻⁶	90	¹ PAKHOVA	09	BELL	$e^+e^- \rightarrow \psi(4360) \rightarrow D^0 D^{*-} \pi^+$
¹ Using $4355^{+9}_{-10} \pm 9$ MeV for the mass of $\psi(4360)$.					

NODE=M181R02
NODE=M181R02

NODE=M181R02;LINKAGE=PA

$\Gamma(D_1(2420)\bar{D} + \text{c.c.})/\Gamma_{\text{total}}$				Γ_7/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
possibly seen	¹ ABLIKIM	19AR	BES3	$e^+e^- \rightarrow \pi^+\pi^-D\bar{D}$
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
NODE=M181R05

NODE=M181R05;LINKAGE=A

$\psi(4360)$ REFERENCES

NODE=M181

ABLIKIM	19AR	PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=59910
ABLIKIM	19K	PR D99 019903 (errat.)	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	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BESIII Collab.)	REFID=58029
Also		PR D99 019903 (errat.)	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
PAKHOVA	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

$\psi(4390)$
 $I^G(J^{PC}) = 0^-(1^{--})$
 I needs confirmation.

OMITTED FROM SUMMARY TABLE
 was $X(4390)$

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=M236

NODE=M236

 $\psi(4390)$ MASS

NODE=M236M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
4390 $\pm$ 6 OUR AVERAGE [4392 $\pm$ 7 MeV OUR 2020 AVERAGE]			
4382.0 $\pm$ 13.3 $\pm$ 1.7	¹ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
4391.5 $^{+6.3}_{-6.8} \pm 1.0$	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$

NODE=M236M

NEW

¹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

NODE=M236M;LINKAGE=B

 $\psi(4390)$ WIDTH

NODE=M236W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
139 $^{+16}_{-20}$ OUR AVERAGE [140 $^{+16}_{-21}$ MeV OUR 2020 AVERAGE]			
135.8 $\pm$ 60.8 $\pm$ 22.5	¹ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
139.5 $^{+16.2}_{-20.6} \pm 0.6$	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$

NODE=M236W

NEW

¹ From a fit of the measured cross section in the range $\sqrt{s} = 3.808\text{--}4.600$ GeV.

NODE=M236W;LINKAGE=B

 $\psi(4390)$ DECAY MODES

NODE=M236215;NODE=M236

Mode	Fraction (Γ_i/Γ)
Γ_1 e^+e^-	
Γ_2 $\pi^+\pi^- h_c$	seen
Γ_3 $\eta J/\psi$	seen
Γ_4 $\pi^+\pi^- \psi(3770)$	possibly seen

DESIG=5

DESIG=1

DESIG=4

DESIG=3

 $\psi(4390)$ $\Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M236218

 $\Gamma(\eta J/\psi) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_3\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.4 $\pm$ 2.2	¹ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.5 $\pm$ 1.0	² ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$
1.7 $\pm$ 1.1	³ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$

NODE=M236R04

NODE=M236R04

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.

OCCUR=2

OCCUR=3

NODE=M236R04;LINKAGE=A

NODE=M236R04;LINKAGE=B

NODE=M236R04;LINKAGE=C

 $\psi(4390)$ BRANCHING RATIOS

NODE=M236220

 $\Gamma(\pi^+\pi^- h_c)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^- h_c$

NODE=M236R01

NODE=M236R01

 $\Gamma(\eta J/\psi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ ABLIKIM	200 BES3	$e^+e^- \rightarrow \eta J/\psi$

NODE=M236R03

NODE=M236R03

¹ With a significance of 6.0 σ .

NODE=M236R03;LINKAGE=A

$\Gamma(\pi^+\pi^-\psi(3770))/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT

possibly seen

¹ ABLIKIM	19AR BES3	$e^+e^- \rightarrow \pi^+\pi^- D\bar{D}$

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=M236R02
NODE=M236R02

NODE=M236R02;LINKAGE=A

 $\psi(4390)$ REFERENCES

ABLIKIM	200 PR D102 031101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AR PR D100 032005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17G PRL 118 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)

NODE=M236

REFID=60344
REFID=59910
REFID=57915

NODE=M073

 $\psi(4415)$

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

 $\psi(4415)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

4421 ± 4 OUR ESTIMATE

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

NODE=M073M
→ UNCHECKED ←

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

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

62 ± 20 OUR ESTIMATE

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

NODE=M073W
→ UNCHECKED ←

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

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=M073215;NODE=M073

NODE=M073

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 D\bar{D}$	seen	
$\Gamma_2 D^0\bar{D}^0$	seen	
$\Gamma_3 D^+D^-$	seen	
$\Gamma_4 D^*\bar{D} + \text{c.c.}$	seen	
$\Gamma_5 D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen	
$\Gamma_6 D^*(2010)^+D^- + \text{c.c.}$	seen	
$\Gamma_7 D^*\bar{D}^*$	seen	
$\Gamma_8 D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	seen	
$\Gamma_9 D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen	
$\Gamma_{10} D^0D^-\pi^+ (\text{excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.})$	$< 2.3 \%$	90%
$\Gamma_{11} D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.}$	$(10 \pm 4) \%$	
$\Gamma_{12} D^0D^{*-}\pi^+ + \text{c.c.}$	$< 11 \%$	90%
$\Gamma_{13} D_1(2420)\bar{D} + \text{c.c.}$	possibly seen	
$\Gamma_{14} D_s^+D_s^-$	not seen	
$\Gamma_{15} \omega\chi_{c2}$	possibly seen	
$\Gamma_{16} D_s^{*+}D_s^- + \text{c.c.}$	seen	
$\Gamma_{17} D_s^{*+}D_s^{*-}$	not seen	
$\Gamma_{18} \psi_2(3823)\pi^+\pi^-$	possibly seen	
$\Gamma_{19} \psi(3770)\pi^+\pi^-$	possibly seen	
$\Gamma_{20} J/\psi\eta$	$< 6 \times 10^{-3}$	90%
$\Gamma_{21} \chi_{c1}\gamma$	$< 8 \times 10^{-4}$	90%
$\Gamma_{22} \chi_{c2}\gamma$	$< 4 \times 10^{-3}$	90%
$\Gamma_{23} e^+e^-$	$(9.4 \pm 3.2) \times 10^{-6}$	

DESIG=7;OUR EVAL;→ UNCHECKED ←
 DESIG=8
 DESIG=9
 DESIG=10;OUR EVAL;→ UNCHECKED ←
 DESIG=11
 DESIG=12
 DESIG=13;OUR EVAL;→ UNCHECKED ←
 DESIG=14
 DESIG=15
 DESIG=4
 DESIG=5
 DESIG=6
 DESIG=25
 DESIG=16
 DESIG=20
 DESIG=17
 DESIG=18
 DESIG=21
 DESIG=24
 DESIG=19
 DESIG=22
 DESIG=23
 DESIG=1

 $\psi(4415)$ PARTIAL WIDTHS

NODE=M073220

$\Gamma(e^+e^-)$	DOCUMENT ID	TECN	COMMENT	Γ_{23}
VALUE (keV)				
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^-	
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 $\delta = (234 \pm 88)^\circ$.				
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.				
13 From a fit to Crystal Ball (OSTERHELD 86) data.				
14 From a fit to BES (BAI 02C) data.				

NODE=M073W1
 NODE=M073W1
 → UNCHECKED ←

OCCUR=2

NODE=M073W1;LINKAGE=AB

NODE=M073W1;LINKAGE=MO

NODE=M073W1;LINKAGE=ST
 NODE=M073W1;LINKAGE=SE

 $\psi(4415) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M073230

$\Gamma(J/\psi\eta) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$	CL%	DOCUMENT ID	TECN	COMMENT	$\Gamma_{20}\Gamma_{23}/\Gamma$
VALUE (eV)					
<3.6	90	WANG	13B BELL	$e^+e^- \rightarrow J/\psi\eta\gamma$	

NODE=M073G01
 NODE=M073G01

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{21}\Gamma_{23}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<0.47	90	¹⁵ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c1}\gamma$
¹⁵ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.				

NODE=M073G02
NODE=M073G02

NODE=M073G02;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}} \quad \Gamma_{22}\Gamma_{23}/\Gamma$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT
<2.3	90	¹⁶ HAN	15 BELL	10.58 $e^+e^- \rightarrow \chi_{c2}\gamma$
¹⁶ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.				

NODE=M073G03
NODE=M073G03

NODE=M073G03;LINKAGE=A

$\psi(4415)$ BRANCHING RATIOS

$$\Gamma(D^0\bar{D}^0)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	PAKHOLOVA	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	PAKHOLOVA	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

$$\Gamma(D\bar{D})/\Gamma(D^*\bar{D}^*) \quad \Gamma_1/\Gamma_7$$

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

$$\Gamma(D^*(2007)^0\bar{D}^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

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	¹⁷ 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	PAKHOLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^-\gamma$

NODE=M073R07
NODE=M073R07

¹⁷ Supersedes PAKHOLOVA 07.

NODE=M073R07;LINKAGE=A

$$\Gamma(D^*\bar{D} + \text{c.c.})/\Gamma(D^*\bar{D}^*) \quad \Gamma_4/\Gamma_7$$

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

$$\Gamma(D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	AUBERT	09M BABR	$e^+e^- \rightarrow D^{*0}\bar{D}^{*0}\gamma$

NODE=M073R08
NODE=M073R08

$$\Gamma(D^*(2010)^+D^*(2010)^- + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹⁸ 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	PAKHOLOVA	07 BELL	$e^+e^- \rightarrow D^{*+}D^{*-}\gamma$

NODE=M073R09
NODE=M073R09

¹⁸ Supersedes PAKHOLOVA 07.

NODE=M073R09;LINKAGE=A

$$\Gamma(D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.})/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
10.5±2.4±3.8	¹⁹ PAKHOLOVA	08A BELL	10.6 $e^+e^- \rightarrow D^0D^-\pi^+\gamma$

NODE=M073R3
NODE=M073R3

¹⁹ Using 4421 ± 4 MeV for the mass and 62 ± 20 MeV for the width of $\psi(4415)$.

NODE=M073R3;LINKAGE=PA

$$\frac{\Gamma(D^0 D^- \pi^+ (\text{excl. } D^*(2007)^0 \bar{D}^0 + \text{c.c.}, D^*(2010)^+ D^- + \text{c.c.}) / \Gamma(D \bar{D}_2^*(2460) \rightarrow D^0 D^- \pi^+ + \text{c.c.})}{\Gamma_{10}/\Gamma_{11}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.22	90	20 PAKHLOVA	08A BELL	10.6 $e^+ e^- \rightarrow D^0 D^- \pi^+ \gamma$
20 Using 4421 $\pm$ 4 MeV for the mass and 62 $\pm$ 20 MeV for the width of $\psi(4415)$.				

NODE=M073R4
NODE=M073R4

NODE=M073R4;LINKAGE=PA

$$\frac{\Gamma(D^0 D^{*-} \pi^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}}{\Gamma_{12}/\Gamma \times \Gamma_{23}/\Gamma}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.99 $\times 10^{-6}$	90	21 PAKHLOVA	09 BELL	$e^+ e^- \rightarrow D^0 D^{*-} \pi^+$
21 Using 4421 $\pm$ 4 MeV for the mass of $\psi(4415)$.				

NODE=M073R01
NODE=M073R01

NODE=M073R01;LINKAGE=PA

$$\frac{\Gamma(D_1(2420) \bar{D} + \text{c.c.})/\Gamma_{\text{total}}}{\Gamma_{13}/\Gamma}$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	22 ABLIKIM	19AR BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$
22 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

$$\frac{\Gamma(D_s^+ D_s^-)/\Gamma_{\text{total}}}{\Gamma_{14}/\Gamma}$$

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

$$\frac{\Gamma(\omega \chi_{c2})/\Gamma_{\text{total}}}{\Gamma_{15}/\Gamma}$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	ABLIKIM	16A BES3	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \pi^0 \ell^+ \ell^-$

NODE=M073R00
NODE=M073R00

$$\frac{\Gamma(D_s^{*+} D_s^- + \text{c.c.})/\Gamma_{\text{total}}}{\Gamma_{16}/\Gamma}$$

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

$$\frac{\Gamma(D_s^{*+} D_s^{*-})/\Gamma_{\text{total}}}{\Gamma_{17}/\Gamma}$$

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=M073R12
NODE=M073R12

$$\frac{\Gamma(\psi(3770) \pi^+ \pi^-)/\Gamma_{\text{total}}}{\Gamma_{19}/\Gamma}$$

VALUE	DOCUMENT ID	TECN	COMMENT
possibly seen	23 ABLIKIM	19AR BES3	$e^+ e^- \rightarrow \pi^+ \pi^- D \bar{D}$
23 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

$$\frac{\Gamma(\psi_2(3823) \pi^+ \pi^-)/\Gamma_{\text{total}}}{\Gamma_{18}/\Gamma}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
possibly seen	19	24 ABLIKIM	15S BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \chi_{c1} \gamma$
24 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

$\psi(4415)$ REFERENCES

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=59910
REFID=58710
REFID=57122
REFID=56784
REFID=56816
REFID=55377
REFID=53638
REFID=53532
REFID=53540
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REFID=53143
REFID=52142
REFID=52132
REFID=52134
REFID=51628
REFID=50813
REFID=50506
REFID=50503
REFID=51064
REFID=22232
REFID=22243

$Z_c(4430)$

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

G, C need confirmation.

was $X(4430)^\pm$

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

 $Z_c(4430)$ MASS

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

NODE=M195M

NODE=M195M;LINKAGE=A
NODE=M195M;LINKAGE=MI
NODE=M195M;LINKAGE=CH

 $Z_c(4430)$ WIDTH

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

NODE=M195W

NODE=M195W;LINKAGE=A
NODE=M195W;LINKAGE=MI
NODE=M195W;LINKAGE=CH

 $Z_c(4430)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \pi^+\psi(2S)$	seen
$\Gamma_2 \quad \pi^+J/\psi$	seen

NODE=M195215;NODE=M195

DESIG=1

DESIG=2

 $Z_c(4430)$ BRANCHING RATIOS **$\Gamma(\pi^+\psi(2S))/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

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	$B \rightarrow K\pi^+\psi(2S)$

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 $B(B^0 \rightarrow Z_c(4430)^- K^+) \times B(Z_c(4430)^- \rightarrow \psi(2S)\pi^-) = (6.0^{+1.7+2.5}_{-2.0-1.4}) \times 10^{-5}$.

³ AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 Z_c(4430)^+) \times B(Z_c(4430)^+ \rightarrow \pi^+\psi(2S)) < 4.7 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- Z_c(4430)^+) \times B(Z_c(4430)^+ \rightarrow \pi^+\psi(2S)) < 3.1 \times 10^{-5}$ at 95% CL.

⁴ Measured a product of branching fractions $B(\bar{B}^0 \rightarrow K^- Z_c(4430)^+) \times B(Z_c(4430)^+ \rightarrow \pi^+\psi(2S)) = (3.2^{+1.8+5.3}_{-0.9-1.6}) \times 10^{-5}$. Superseded by CHILIKIN 13.

NODE=M195225

NODE=M195R01
NODE=M195R01

NODE=M195R01;LINKAGE=AA
NODE=M195R01;LINKAGE=A

NODE=M195R01;LINKAGE=AU

NODE=M195R01;LINKAGE=MI

$\Gamma(\pi^+ J/\psi)/\Gamma_{\text{total}}$ 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 $B(\bar{B}^0 \rightarrow Z_c(4430)^+ K^-) \times B(Z_c(4430)^+ \rightarrow J/\psi \pi^+) = (5.4^{+4.0+1.1}_{-1.0-0.9}) \times 10^{-6}$.			
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 $Z_c(4430)$, $Z_c(4200)$ and the fitting polynomials.			
3 AUBERT 09AA quotes $B(B^+ \rightarrow \bar{K}^0 Z_c(4430)^+) \times B(Z_c(4430)^+ \rightarrow \pi^+ J/\psi) < 1.5 \times 10^{-5}$ and $B(\bar{B}^0 \rightarrow K^- Z_c(4430)^+) \times B(Z_c(4430)^+ \rightarrow \pi^+ J/\psi) < 0.4 \times 10^{-5}$ at 95% CL.			

NODE=M195R02
 NODE=M195R02

NODE=M195R02;LINKAGE=A

NODE=M195R02;LINKAGE=E

NODE=M195R02;LINKAGE=AU

 $Z_c(4430)$ 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.)

NODE=M195

REFID=59776
 REFID=57110
 REFID=55896
 REFID=56344
 REFID=55551
 REFID=52940
 REFID=52960
 REFID=52178

NODE=M234

 $\chi_{c0}(4500)$

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

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
$4506 \pm 11^{+12}_{-15}$	4289	1 AAIJ 17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234M

NODE=M234M

1 From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .

NODE=M234M;LINKAGE=A

 $\chi_{c0}(4500)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$92 \pm 21^{+21}_{-20}$	4289	1 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 6.1σ .

NODE=M234W;LINKAGE=A

 $\chi_{c0}(4500)$ DECAY MODES

Mode	Γ_1
$J/\psi \phi$	

NODE=M234215;NODE=M234

DESIG=1

 $\chi_{c0}(4500)$ BRANCHING RATIOS

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$	EVTS	DOCUMENT ID	TECN	COMMENT
seen	4289	1 AAIJ 17C	LHCB	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M234220

NODE=M234R01
 NODE=M234R01

1 From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 6.1σ .

NODE=M234R01;LINKAGE=A

 $\chi_{c0}(4500)$ REFERENCES

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.)

NODE=M234

REFID=57657
 REFID=57636

NODE=M189

 $\psi(4660)$

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

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
4630 $\pm$ 6 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.
 [4633 $\pm$ 7 MeV OUR 2020 AVERAGE Scale factor = 1.4]

NODE=M189M

NEW

4619.8 $^{+8.9}_{-8.0}$ $\pm$ 2.3	66	¹ JIA	20	BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s2}^{*-}(2573)^-$
4625.9 $^{+6.2}_{-6.0}$ $\pm$ 0.4	89	² JIA	19A	BELL	$e^+e^- \rightarrow \gamma D_s^+ D_{s1}^-(2536)^-$
4652 $\pm$ 10 $\pm$ 11	279	³ WANG	15A	BELL	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$
4669 $\pm$ 21 $\pm$ 3	37	⁴ LEES	14F	BABR	10.58 $e^+e^- \rightarrow \gamma \pi^+\pi^-\psi(2S)$
4634 $^{+8}_{-7}$ $^{+5}_{-8}$	142	⁵ PAKHLOVA	08B	BELL	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$

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

4652.5 $\pm$ 3.4 $\pm$ 1.1		⁶ DAI	17	RVUE	$e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
4645.2 $\pm$ 9.5 $\pm$ 6.0		⁷ ZHANG	17B	RVUE	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
4646.4 $\pm$ 9.7 $\pm$ 4.8		⁸ ZHANG	17C	RVUE	$e^+e^- \rightarrow \pi^+\pi^- J/\psi$ or $\psi(2S)$
4661 $^{+9}_{-8}$ $\pm$ 6	44	⁹ 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 Using $D_{s2}^{*}(2573)^- \rightarrow \bar{D}^0 K^-$ decays.

² From a fit of a Breit-Wigner convolved with a Gaussian.

³ From a two-resonance fit. Supersedes WANG 07D.

⁴ From a two-resonance fit.

⁵ The $\pi^+\pi^-\psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.

⁶ The pole parameters are extracted from the speed plot.

⁷ From a three-resonance fit.

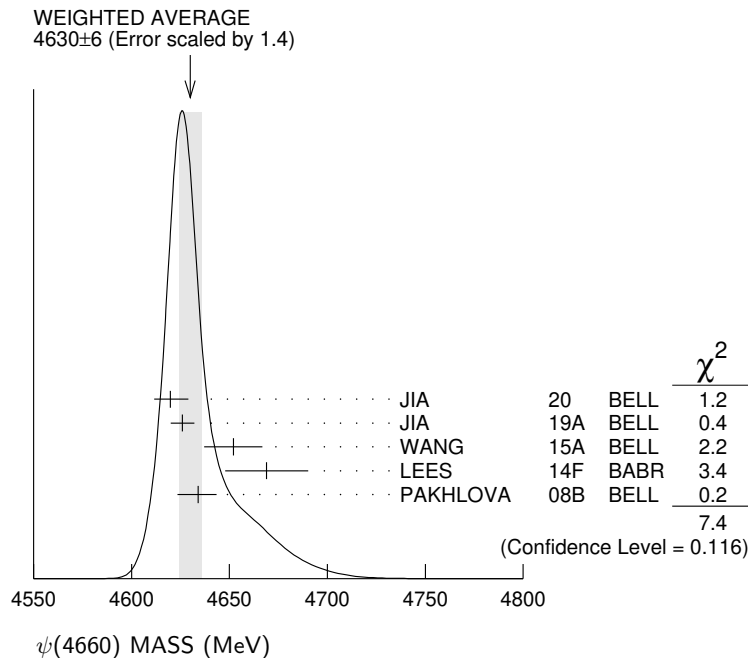
⁸ From a combined fit of BELLE, BABAR and BES3 $e^+e^- \rightarrow \pi^+\pi^- J/\psi$ and $e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$ data.

⁹ 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=C
 NODE=M189M;LINKAGE=D
 NODE=M189M;LINKAGE=B

NODE=M189M;LINKAGE=LI



$\psi(4660)$ WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
62 $\pm$ 9 OUR AVERAGE				
[64 $\pm$ 9 MeV OUR 2020 AVERAGE]				
47.0 $^{+31.3}_{-14.8}$ $\pm$ 4.6	66	¹ JIA	20	BELL $e^+e^- \rightarrow \gamma D_s^+ D_{s2}^{*-}(2573)^-$
49.8 $^{+13.9}_{-11.5}$ $\pm$ 4.0	89	² JIA	19A	BELL $e^+e^- \rightarrow \gamma D_s^+ D_{s1}(2536)^-$
68 $\pm$ 11 $\pm$ 5	279	³ WANG	15A	BELL 10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
104 $\pm$ 48 $\pm$ 10	37	⁴ LEES	14F	BABR 10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
92 $^{+40}_{-24}$ $^{+10}_{-21}$	142	⁵ PAKHLOVA	08B	BELL $e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
62.6 $\pm$ 5.6 $\pm$ 4.3		⁶ DAI	17	RVUE $e^+e^- \rightarrow \Lambda_c^+ \Lambda_c^-$
113.8 $\pm$ 18.1 $\pm$ 3.4		⁷ ZHANG	17B	RVUE $e^+e^- \rightarrow \pi^+ \pi^- \psi(2S)$
103.5 $\pm$ 15.6 $\pm$ 4.0		⁸ ZHANG	17C	RVUE $e^+e^- \rightarrow \pi^+ \pi^- J/\psi$ or $\psi(2S)$
42 $^{+17}_{-12}$ $\pm$ 6	44	⁹ LIU	08H	RVUE 10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
48 $\pm$ 15 $\pm$ 3	44	WANG	07D	BELL 10.58 $e^+e^- \rightarrow \gamma \pi^+ \pi^- \psi(2S)$
¹ Using $D_{s2}^{*-}(2573)^- \rightarrow \bar{D}^0 K^-$ decays.				
² From a fit of a Breit-Wigner convolved with a Gaussian.				
³ From a two-resonance fit. Supersedes WANG 07D.				
⁴ From a two-resonance fit.				
⁵ The $\pi^+ \pi^- \psi(2S)$ and $\Lambda_c^+ \Lambda_c^-$ states are not necessarily the same.				
⁶ The pole parameters are extracted from the speed plot.				
⁷ From a three-resonance fit.				
⁸ 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.				
⁹ From a combined fit of AUBERT 07S and WANG 07D data with two resonances.				

 $\psi(4660)$ 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 $D^0 D^{*-}\pi^+$	not seen
Γ_5 $\chi_{c1}\gamma$	not seen
Γ_6 $\chi_{c2}\gamma$	not seen
Γ_7 $\Lambda_c^+ \Lambda_c^-$	seen
Γ_8 $D_s^+ D_{s1}(2536)^-$	seen
Γ_9 $D_s^+ D_{s2}^{*-}(2573)^-$	

 $\psi(4660) \Gamma(i) \times \Gamma(e^+e^-)/\Gamma(\text{total})$

$\Gamma(\psi(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$2.0 \pm 0.3 \pm 0.2$	279	¹ WANG	15A	BELL $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$8.1 \pm 1.1 \pm 1.0$	279	² WANG	15A	BELL $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$2.7 \pm 1.3 \pm 0.5$	37	³ LEES	14F	BABR $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$7.5 \pm 1.7 \pm 0.7$	37	⁴ LEES	14F	BABR $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$2.2^{+0.7}_{-0.6}$	44	⁵ LIU	08H	RVUE $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
5.9 ± 1.6	44	⁶ LIU	08H	RVUE $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$3.0 \pm 0.9 \pm 0.3$	44	³ WANG	07D	BELL $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
$7.6 \pm 1.8 \pm 0.8$	44	⁴ WANG	07D	BELL $10.58\ e^+e^- \rightarrow \gamma\pi^+\pi^-\psi(2S)$
¹ Solution I of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.				
² Solution II of two equivalent solutions from a fit using two interfering resonances. Supersedes WANG 07D.				
³ Solution I of two equivalent solutions in a fit using two interfering resonances.				
⁴ Solution II of two equivalent solutions in a fit using two interfering resonances.				
⁵ Solution I in a combined fit of AUBERT 07S and WANG 07D data with two resonances.				
⁶ Solution II in a combined fit of AUBERT 07S and WANG 07D data with two resonances.				

NODE=M189W

NODE=M189W

NEW

NODE=M189W;LINKAGE=G
 NODE=M189W;LINKAGE=F
 NODE=M189W;LINKAGE=A
 NODE=M189W;LINKAGE=LE
 NODE=M189W;LINKAGE=B
 NODE=M189W;LINKAGE=D
 NODE=M189W;LINKAGE=E
 NODE=M189W;LINKAGE=C

NODE=M189W;LINKAGE=LI

NODE=M189215;NODE=M189

DESIG=1;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=2;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=4;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=3;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=6;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=7;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=5;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=8;OUR EVAL; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=9

NODE=M189230

NODE=M189G1
 NODE=M189G1

OCCUR=2

OCCUR=2

OCCUR=2

OCCUR=2

NODE=M189G1;LINKAGE=A

NODE=M189G1;LINKAGE=B

NODE=M189G1;LINKAGE=WA
 NODE=M189G1;LINKAGE=WN
 NODE=M189G1;LINKAGE=LI
 NODE=M189G1;LINKAGE=LU

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

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

 $\Gamma_3\Gamma_1/\Gamma$

NODE=M189G01
NODE=M189G01

$$\Gamma(\chi_{c1}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<0.45	90	¹ HAN	15	BELL	$10.58 e^+e^- \rightarrow \chi_{c1}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

 $\Gamma_5\Gamma_1/\Gamma$

NODE=M189G02
NODE=M189G02

NODE=M189G02;LINKAGE=A

$$\Gamma(\chi_{c2}\gamma) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$$

VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT

<2.1	90	¹ HAN	15	BELL	$10.58 e^+e^- \rightarrow \chi_{c2}\gamma$

¹ Using $B(\eta \rightarrow \gamma\gamma) = (39.41 \pm 0.21)\%$.

 $\Gamma_6\Gamma_1/\Gamma$

NODE=M189G03
NODE=M189G03

NODE=M189G03;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 $B(D_{s1}(2536)^- \rightarrow \bar{D}^{*0} K^-) = 1$.

 $\Gamma_8\Gamma_1/\Gamma$

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 $B(D_{s2}^*(2573)^- \rightarrow \bar{D}^0 K^-) = 1$.

 $\Gamma_9\Gamma_1/\Gamma$

NODE=M189R04
NODE=M189R04

NODE=M189R04;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

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

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.

 $\Gamma_7/\Gamma \times \Gamma_1/\Gamma$

NODE=M189R03
NODE=M189R03

NODE=M189R03;LINKAGE=A

$\psi(4660)$ REFERENCES

NODE=M189

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.)

REFID=60301
REFID=60037
REFID=58704
REFID=58219
REFID=58463
REFID=56816
REFID=56839
REFID=55938
REFID=55377
REFID=53143
REFID=52296
REFID=52596
REFID=51724
REFID=51959

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 amplitude analysis of $B^+ \rightarrow J/\psi \phi K^+$ with a significance (accounting for systematic uncertainties) of 5.6σ .

$\chi_{c0}(4700)$ MASS

NODE=M235M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$4704 \pm 10^{+14}_{-24}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M235M

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .

NODE=M235M;LINKAGE=A

$\chi_{c0}(4700)$ WIDTH

NODE=M235W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$120 \pm 31^{+42}_{-33}$	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$

NODE=M235W

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .

NODE=M235W;LINKAGE=A

$\chi_{c0}(4700)$ 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

$\Gamma(J/\psi \phi)/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	¹ AAIJ	17C LHCb	$B^+ \rightarrow J/\psi \phi K^+$	

NODE=M235R01
NODE=M235R01

¹ From an amplitude analysis of the decay $B^+ \rightarrow J/\psi \phi K^+$ with a significance of 5.6σ .

NODE=M235R01;LINKAGE=A

$\chi_{c0}(4700)$ REFERENCES

NODE=M235

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.)

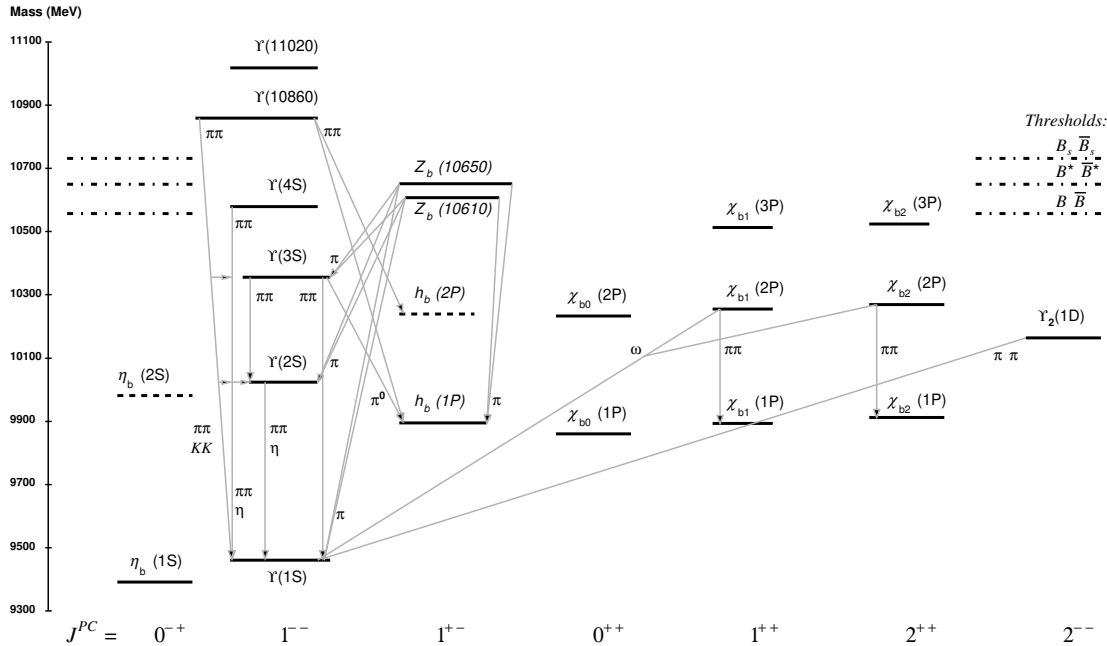
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REFID=57636

$b\bar{b}$ MESONS (including possibly non- $q\bar{q}$ states)

NODE=MXXX030

NODE=M849

Updated August 2019.



The level scheme of meson states containing a minimal quark content of $b\bar{b}$. 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.

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

$$\Gamma = \Gamma_{\ell\ell}/B_{\ell\ell} , \quad (1)$$

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

$$\begin{aligned}\Gamma_{\ell\ell} &= \Gamma_{ee} \\ B_{\ell\ell} &= \text{average of } B_{ee}, B_{\mu\mu}, \text{ and } B_{\tau\tau} .\end{aligned}\quad (2)$$

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

$$\Gamma_{\text{had}} + 3\Gamma_{ee} = \Gamma . \quad (3)$$

This combination is obtained experimentally from the energy-integrated hadronic cross section

$$\begin{aligned}\int_{\text{resonance}} \sigma(e^+e^- \rightarrow \Upsilon \rightarrow \text{hadrons})dE \\ = \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma} C_r = \frac{6\pi^2}{M^2} \frac{\Gamma_{ee}^{(0)}\Gamma_{\text{had}}}{\Gamma} C_r^{(0)} ,\end{aligned}\quad (4)$$

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. (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

$$\Gamma_{ee} = \frac{\Gamma_{ee}\Gamma_{\text{had}}}{\Gamma(1 - 3B_{\ell\ell})} . \quad (5)$$

The total width Γ is then obtained from Eq. (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. (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.

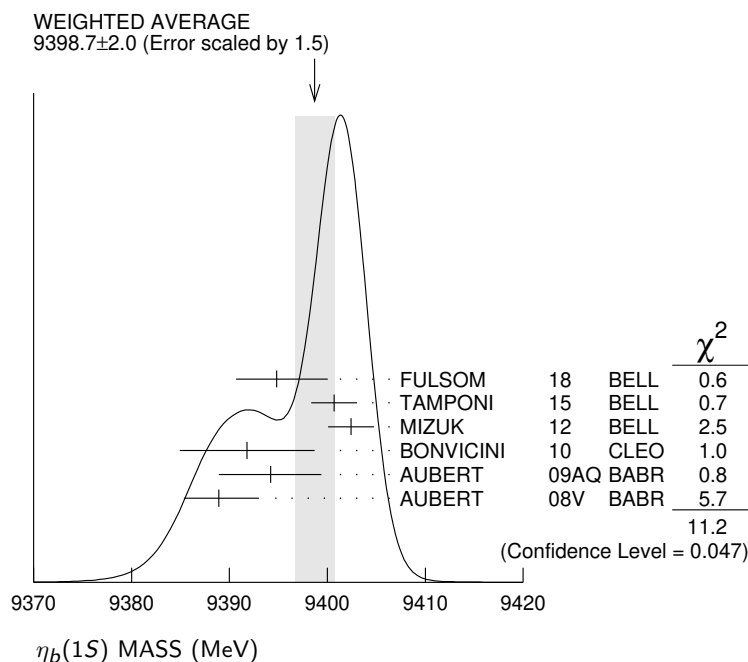
² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass difference measurements.

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

¹ With floating width. Not independent of the corresponding mass measurement.

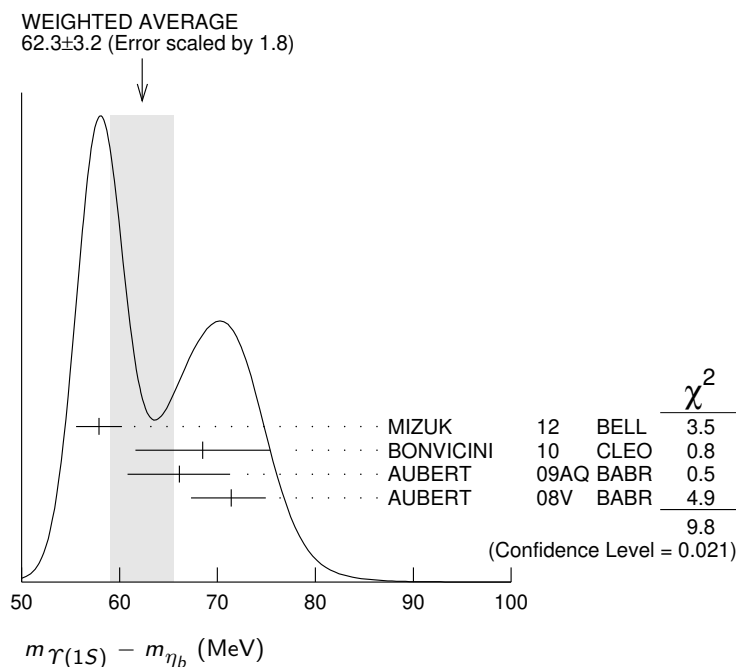
² Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding γ energy or mass measurements.

³ Obtained 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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
920.6^{+2.8}_{-3.2} OUR AVERAGE				
918.6±6.0±1.9	2.3±0.5k	¹ BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
921.2 ^{+2.1} _{-2.8} ±2.4	19±3k	¹ AUBERT	08v BABR	$\Upsilon(3S) \rightarrow \gamma X$

NODE=M171DM

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171DM;LINKAGE=BO

γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M171U2S

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
609.3^{+4.6}_{-4.5}±1.9	13±5k	¹ AUBERT	09AQ BABR	$\Upsilon(2S) \rightarrow \gamma X$

NODE=M171U2S

¹ Assuming $\Gamma_{\eta_b(1S)} = 10$ MeV. Not independent of the corresponding mass or mass difference measurements.

NODE=M171U2S;LINKAGE=AU

$\eta_b(1S)$ WIDTH

NODE=M171W

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10⁺⁵₋₄ OUR AVERAGE				
8 ⁺⁶ ₋₅ ±5	33.1k	¹ TAMPONI	15 BELL	$e^+e^- \rightarrow \gamma\eta + \text{hadrons}$
10.8 ^{+4.0} _{-3.7} +4.5 -2.0	34k	¹ MIZUK	12 BELL	$e^+e^- \rightarrow \gamma\pi^+\pi^- + \text{hadrons}$

NODE=M171W

¹ With 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%

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%

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%

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
VALUE	EVTS
seen	34k

NODE=M171R03

NODE=M171R03

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$	Γ_6/Γ
VALUE	CL%

NODE=M171R01

NODE=M171R01

< 9×10^{-3} 90 ¹AUBERT 09Z BABR $e^+e^- \rightarrow \Upsilon(2S, 3S) \rightarrow \gamma\eta_b$

¹Obtained 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%
< 8×10^{-2}	90

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

$\Upsilon(1S)$

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

NODE=M049

 $\Upsilon(1S)$ MASS

NODE=M049M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
9460.30±0.26 OUR AVERAGE	Error includes scale factor of 3.3.		
9460.51±0.09±0.05	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
9459.97±0.11±0.07	MACKAY 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9460.60±0.09±0.05	^{2,3} BARU	92B REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.59±0.12	BARU 86	REDE	$e^+e^- \rightarrow \text{hadrons}$
9460.6 ±0.4	^{3,4} ARTAMONOV 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 92B and ARTAMONOV 84 using new electron mass (COHEN 87).			
² Superseding BARU 86.			
³ Superseded by ARTAMONOV 00.			
⁴ Value includes data of ARTAMONOV 82.			

NODE=M049M

NODE=M049M;LINKAGE=AR
 NODE=M049M;LINKAGE=A
 NODE=M049M;LINKAGE=RZ
 NODE=M049M;LINKAGE=G

 $\Upsilon(1S)$ WIDTH

NODE=M049W

VALUE (keV)	DOCUMENT ID
54.02±1.25 OUR EVALUATION	See the Note on "Width Determinations of the Υ States"

NODE=M049W
 → UNCHECKED ←

 $\Upsilon(1S)$ DECAY MODES

NODE=M049215;NODE=M049

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
$\Gamma_1 \quad \tau^+ \tau^-$	(2.60 ±0.10) %	
$\Gamma_2 \quad e^+ e^-$	(2.38 ±0.11) %	
$\Gamma_3 \quad \mu^+ \mu^-$	(2.48 ±0.05) %	
Hadronic decays		
$\Gamma_4 \quad g g g$	(81.7 ±0.7) %	
$\Gamma_5 \quad \gamma g g$	(2.2 ±0.6) %	
$\Gamma_6 \quad \eta'(958) \text{ anything}$	(2.94 ±0.24) %	
$\Gamma_7 \quad J/\psi(1S) \text{ anything}$	(5.4 ±0.4) × 10 ⁻⁴	S=1.4
$\Gamma_8 \quad J/\psi(1S) \eta_c$	< 2.2	× 10 ⁻⁶ CL=90%
$\Gamma_9 \quad J/\psi(1S) \chi_{c0}$	< 3.4	× 10 ⁻⁶ CL=90%
$\Gamma_{10} \quad J/\psi(1S) \chi_{c1}$	(3.9 ±1.2) × 10 ⁻⁶	
$\Gamma_{11} \quad J/\psi(1S) \chi_{c2}$	< 1.4	× 10 ⁻⁶ CL=90%
$\Gamma_{12} \quad J/\psi(1S) \eta_c(2S)$	< 2.2	× 10 ⁻⁶ CL=90%
$\Gamma_{13} \quad J/\psi(1S) X(3940)$	< 5.4	× 10 ⁻⁶ CL=90%
$\Gamma_{14} \quad J/\psi(1S) X(4160)$	< 5.4	× 10 ⁻⁶ CL=90%
$\Gamma_{15} \quad X(4350) \text{ anything, } X \rightarrow J/\psi(1S) \phi$	< 8.1	× 10 ⁻⁶ CL=90%
$\Gamma_{16} \quad Z_c(3900)^\pm \text{ anything, } Z_c \rightarrow J/\psi(1S) \pi^\pm$	< 1.3	× 10 ⁻⁵ CL=90%
$\Gamma_{17} \quad Z_c(4200)^\pm \text{ anything, } Z_c \rightarrow J/\psi(1S) \pi^\pm$	< 6.0	× 10 ⁻⁵ CL=90%
$\Gamma_{18} \quad Z_c(4430)^\pm \text{ anything, } Z_c \rightarrow J/\psi(1S) \pi^\pm$	< 4.9	× 10 ⁻⁵ CL=90%
$\Gamma_{19} \quad X_{cs}^\pm \text{ anything, } X \rightarrow J/\psi K^\pm$	< 5.7	× 10 ⁻⁶ CL=90%
$\Gamma_{20} \quad \psi(4260) \text{ anything, } \psi \rightarrow J/\psi(1S) \pi^+ \pi^-$	< 3.8	× 10 ⁻⁵ CL=90%
$\Gamma_{21} \quad \psi(4260) \text{ anything, } \psi \rightarrow J/\psi(1S) K^+ K^-$	< 7.5	× 10 ⁻⁶ CL=90%
$\Gamma_{22} \quad \chi_{c1}(4140) \text{ anything, } \chi_{c1} \rightarrow J/\psi(1S) \phi$	< 5.2	× 10 ⁻⁶ CL=90%
$\Gamma_{23} \quad \chi_{c0} \text{ anything}$	< 4	× 10 ⁻³ CL=90%
$\Gamma_{24} \quad \chi_{c1} \text{ anything}$	(1.90 ±0.35) × 10 ⁻⁴	
$\Gamma_{25} \quad \chi_{c1}(1P) X_{tetra}$	< 3.78	× 10 ⁻⁵ CL=90%

DESIG=3

DESIG=2

DESIG=1

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

DESIG=166

DESIG=5

DESIG=6

DESIG=175

Г ₂₆	χ_{c2} anything	$(2.8 \pm 0.8) \times 10^{-4}$		DESIG=7
Г ₂₇	$\psi(2S)$ anything	$(1.23 \pm 0.20) \times 10^{-4}$		DESIG=8
Г ₂₈	$\psi(2S)\eta_c$	$< 3.6 \times 10^{-6}$	CL=90%	DESIG=153
Г ₂₉	$\psi(2S)\chi_{c0}$	$< 6.5 \times 10^{-6}$	CL=90%	DESIG=154
Г ₃₀	$\psi(2S)\chi_{c1}$	$< 4.5 \times 10^{-6}$	CL=90%	DESIG=155
Г ₃₁	$\psi(2S)\chi_{c2}$	$< 2.1 \times 10^{-6}$	CL=90%	DESIG=156
Г ₃₂	$\psi(2S)\eta_c(2S)$	$< 3.2 \times 10^{-6}$	CL=90%	DESIG=157
Г ₃₃	$\psi(2S)X(3940)$	$< 2.9 \times 10^{-6}$	CL=90%	DESIG=158
Г ₃₄	$\psi(2S)X(4160)$	$< 2.9 \times 10^{-6}$	CL=90%	DESIG=159
Г ₃₅	$\psi(4260)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	$< 7.9 \times 10^{-5}$	CL=90%	DESIG=162
Г ₃₆	$\psi(4360)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	$< 5.2 \times 10^{-5}$	CL=90%	DESIG=163
Г ₃₇	$\psi(4660)$ anything, $\psi \rightarrow \psi(2S)\pi^+\pi^-$	$< 2.2 \times 10^{-5}$	CL=90%	DESIG=164
Г ₃₈	$X(4050)^\pm$ anything, $X \rightarrow \psi(2S)\pi^\pm$	$< 8.8 \times 10^{-5}$	CL=90%	DESIG=171
Г ₃₉	$Z_c(4430)^\pm$ anything, $Z_c \rightarrow \psi(2S)\pi^\pm$	$< 6.7 \times 10^{-5}$	CL=90%	DESIG=172
Г ₄₀	$\chi_{c1}(3872)$ anything	$< 2.6 \times 10^{-4}$	CL=90%	DESIG=194
Г ₄₁	$Z_c(4200)^+ Z_c(4200)^-$	$< 2.23 \times 10^{-5}$	CL=90%	DESIG=178
Г ₄₂	$Z_c(3900)^\pm Z_c(4200)^\mp$	$< 8.1 \times 10^{-6}$	CL=90%	DESIG=179
Г ₄₃	$Z_c(3900)^+ Z_c(3900)^-$	$< 1.8 \times 10^{-6}$	CL=90%	DESIG=180
Г ₄₄	$X(4050)^+ X(4050)^-$	$< 1.58 \times 10^{-5}$	CL=90%	DESIG=181
Г ₄₅	$X(4250)^+ X(4250)^-$	$< 2.66 \times 10^{-5}$	CL=90%	DESIG=182
Г ₄₆	$X(4050)^\pm X(4250)^\mp$	$< 4.42 \times 10^{-5}$	CL=90%	DESIG=183
Г ₄₇	$Z_c(4430)^+ Z_c(4430)^-$	$< 2.03 \times 10^{-5}$	CL=90%	DESIG=184
Г ₄₈	$X(4055)^\pm X(4055)^\mp$	$< 2.33 \times 10^{-5}$	CL=90%	DESIG=186
Г ₄₉	$X(4055)^\pm Z_c(4430)^\mp$	$< 4.55 \times 10^{-5}$	CL=90%	DESIG=189
Г ₅₀	$\rho\pi$	$< 3.68 \times 10^{-6}$	CL=90%	DESIG=11
Г ₅₁	$\omega\pi^0$	$< 3.90 \times 10^{-6}$	CL=90%	DESIG=131
Г ₅₂	$\pi^+\pi^-$	$< 5 \times 10^{-4}$	CL=90%	DESIG=23
Г ₅₃	K^+K^-	$< 5 \times 10^{-4}$	CL=90%	DESIG=24
Г ₅₄	$p\bar{p}$	$< 5 \times 10^{-4}$	CL=90%	DESIG=25
Г ₅₅	$\pi^+\pi^-\pi^0$	$(2.1 \pm 0.8) \times 10^{-6}$		DESIG=72
Г ₅₆	ϕK^+K^-	$(2.4 \pm 0.5) \times 10^{-6}$		DESIG=136
Г ₅₇	$\omega\pi^+\pi^-$	$(4.5 \pm 1.0) \times 10^{-6}$		DESIG=137
Г ₅₈	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(4.4 \pm 0.8) \times 10^{-6}$		DESIG=138
Г ₅₉	$\phi f'_2(1525)$	$< 1.63 \times 10^{-6}$	CL=90%	DESIG=139
Г ₆₀	$\omega f_2(1270)$	$< 1.79 \times 10^{-6}$	CL=90%	DESIG=140
Г ₆₁	$\rho(770) a_2(1320)$	$< 2.24 \times 10^{-6}$	CL=90%	DESIG=141
Г ₆₂	$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	$(3.0 \pm 0.8) \times 10^{-6}$		DESIG=142
Г ₆₃	$K_1(1270)^\pm K^\mp$	$< 2.41 \times 10^{-6}$	CL=90%	DESIG=143
Г ₆₄	$K_1(1400)^\pm K^\mp$	$(1.0 \pm 0.4) \times 10^{-6}$		DESIG=144
Г ₆₅	$b_1(1235)^\pm \pi^\mp$	$< 1.25 \times 10^{-6}$	CL=90%	DESIG=145
Г ₆₆	$\pi^+\pi^-\pi^0\pi^0$	$(1.28 \pm 0.30) \times 10^{-5}$		DESIG=132
Г ₆₇	$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=133
Г ₆₈	$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(2.9 \pm 0.9) \times 10^{-6}$		DESIG=134
Г ₆₉	$K^*(892)^- K^+ + \text{c.c.}$	$< 1.11 \times 10^{-6}$	CL=90%	DESIG=135
Г ₇₀	$f_1(1285)$ anything	$(4.6 \pm 3.1) \times 10^{-3}$		DESIG=174
Г ₇₁	$D^*(2010)^\pm$ anything	$(2.52 \pm 0.20) \%$		DESIG=30
Г ₇₂	$\bar{f}_1(1285) X_{tetra}$	$< 6.24 \times 10^{-5}$	CL=90%	DESIG=176
Г ₇₃	${}^2H$ anything	$(2.85 \pm 0.25) \times 10^{-5}$		DESIG=107
Г ₇₄	Sum of 100 exclusive modes	$(1.200 \pm 0.017) \%$		DESIG=128

Radiative decays

NODE=M049;CLUMP=B

Г ₇₅	$\gamma\pi^+\pi^-$	(6.3 ±1.8) × 10 ⁻⁵		DESIG=70
Г ₇₆	$\gamma\pi^0\pi^0$	(1.7 ±0.7) × 10 ⁻⁵		DESIG=71
Г ₇₇	$\gamma\pi\pi$ (S-wave)	(4.6 ±0.7) × 10 ⁻⁵		DESIG=190
Г ₇₈	$\gamma\pi^0\eta$	< 2.4 × 10 ⁻⁶	CL=90%	DESIG=111
Г ₇₉	$\gamma K^+ K^-$	[a] (1.14 ±0.13) × 10 ⁻⁵		DESIG=102
Г ₈₀	$\gamma p\bar{p}$	[b] < 6 × 10 ⁻⁶	CL=90%	DESIG=103
Г ₈₁	$\gamma 2h^+ 2h^-$	(7.0 ±1.5) × 10 ⁻⁴		DESIG=20
Г ₈₂	$\gamma 3h^+ 3h^-$	(5.4 ±2.0) × 10 ⁻⁴		DESIG=21
Г ₈₃	$\gamma 4h^+ 4h^-$	(7.4 ±3.5) × 10 ⁻⁴		DESIG=22
Г ₈₄	$\gamma\pi^+\pi^- K^+ K^-$	(2.9 ±0.9) × 10 ⁻⁴		DESIG=14
Г ₈₅	$\gamma 2\pi^+ 2\pi^-$	(2.5 ±0.9) × 10 ⁻⁴		DESIG=13
Г ₈₆	$\gamma 3\pi^+ 3\pi^-$	(2.5 ±1.2) × 10 ⁻⁴		DESIG=17
Г ₈₇	$\gamma 2\pi^+ 2\pi^- K^+ K^-$	(2.4 ±1.2) × 10 ⁻⁴		DESIG=18
Г ₈₈	$\gamma\pi^+\pi^- p\bar{p}$	(1.5 ±0.6) × 10 ⁻⁴		DESIG=15
Г ₈₉	$\gamma 2\pi^+ 2\pi^- p\bar{p}$	(4 ±6) × 10 ⁻⁵		DESIG=19
Г ₉₀	$\gamma 2K^+ 2K^-$	(2.0 ±2.0) × 10 ⁻⁵		DESIG=16
Г ₉₁	$\gamma\eta'(958)$	< 1.9 × 10 ⁻⁶	CL=90%	DESIG=55
Г ₉₂	$\gamma\eta$	< 1.0 × 10 ⁻⁶	CL=90%	DESIG=54
Г ₉₃	$\gamma f_0(980)$	< 3 × 10 ⁻⁵	CL=90%	DESIG=105
Г ₉₄	$\gamma f'_2(1525)$	(2.9 ±0.6) × 10 ⁻⁵		DESIG=52
Г ₉₅	$\gamma f_2(1270)$	(1.01 ±0.06) × 10 ⁻⁴		DESIG=51
Г ₉₆	$\gamma\eta(1405)$	< 8.2 × 10 ⁻⁵	CL=90%	DESIG=65
Г ₉₇	$\gamma f_0(1500)$	< 1.5 × 10 ⁻⁵	CL=90%	DESIG=108
Г ₉₈	$\gamma f_0(1500) \rightarrow \gamma K^+ K^-$	(1.0 ±0.4) × 10 ⁻⁵		DESIG=192
Г ₉₉	$\gamma f_0(1710)$	< 2.6 × 10 ⁻⁴	CL=90%	DESIG=53
Г ₁₀₀	$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	(1.01 ±0.32) × 10 ⁻⁵		DESIG=112
Г ₁₀₁	$\gamma f_0(1710) \rightarrow \gamma\pi^+\pi^-$	(5.3 ±2.0) × 10 ⁻⁶		DESIG=191
Г ₁₀₂	$\gamma f_0(1710) \rightarrow \gamma\pi^0\pi^0$	< 1.4 × 10 ⁻⁶	CL=90%	DESIG=109
Г ₁₀₃	$\gamma f_0(1710) \rightarrow \gamma\eta\eta$	< 1.8 × 10 ⁻⁶	CL=90%	DESIG=110
Г ₁₀₄	$\gamma f_4(2050)$	< 5.3 × 10 ⁻⁵	CL=90%	DESIG=104
Г ₁₀₅	$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	< 2 × 10 ⁻⁴	CL=90%	DESIG=69
Г ₁₀₆	$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	< 8 × 10 ⁻⁷	CL=90%	DESIG=60
Г ₁₀₇	$\gamma f_J(2220) \rightarrow \gamma\pi^+\pi^-$	< 6 × 10 ⁻⁷	CL=90%	DESIG=61
Г ₁₀₈	$\gamma f_J(2220) \rightarrow \gamma p\bar{p}$	< 1.1 × 10 ⁻⁶	CL=90%	DESIG=62
Г ₁₀₉	$\gamma\eta(2225) \rightarrow \gamma\phi\phi$	< 3 × 10 ⁻³	CL=90%	DESIG=68
Г ₁₁₀	$\gamma\eta_c(1S)$	< 2.9 × 10 ⁻⁵	CL=90%	DESIG=119
Г ₁₁₁	$\gamma\eta_c(2S)$	< 4 × 10 ⁻⁴	CL=90%	DESIG=193
Г ₁₁₂	$\gamma\chi_{c0}$	< 6.6 × 10 ⁻⁵	CL=90%	DESIG=120
Г ₁₁₃	$\gamma\chi_{c1}$	(4.7 ^{+2.4} _{-1.9}) × 10 ⁻⁵		DESIG=121
Г ₁₁₄	$\gamma\chi_{c2}$	< 7.6 × 10 ⁻⁶	CL=90%	DESIG=122
Г ₁₁₅	$\gamma\chi_{c1}(3872)$	< 4 × 10 ⁻⁵	CL=90%	DESIG=195
Г ₁₁₆	$\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.8 × 10 ⁻⁶	CL=90%	DESIG=124
Г ₁₁₇	$\gamma X(3915) \rightarrow \omega J/\psi$	< 3.0 × 10 ⁻⁶	CL=90%	DESIG=125
Г ₁₁₈	$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 2.2 × 10 ⁻⁶	CL=90%	DESIG=126
Г ₁₁₉	γX	[c] < 4.5 × 10 ⁻⁶	CL=90%	DESIG=66
Г ₁₂₀	$\gamma X\bar{X} (m_X < 3.1 \text{ GeV})$	[d] < 1 × 10 ⁻³	CL=90%	DESIG=67
Г ₁₂₁	$\gamma X\bar{X} (m_X < 4.5 \text{ GeV})$	[e] < 2.4 × 10 ⁻⁴	CL=90%	DESIG=127
Г ₁₂₂	$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[f] < 1.78 × 10 ⁻⁴	CL=95%	DESIG=113
Г ₁₂₃	$\gamma a_1^0 \rightarrow \gamma\mu^+\mu^-$	[g] < 9 × 10 ⁻⁶	CL=90%	DESIG=114
Г ₁₂₄	$\gamma a_1^0 \rightarrow \gamma\tau^+\tau^-$	[a] < 1.30 × 10 ⁻⁴	CL=90%	DESIG=115
Г ₁₂₅	$\gamma a_1^0 \rightarrow \gamma g g$	[h] < 1 %	CL=90%	DESIG=129
Г ₁₂₆	$\gamma a_1^0 \rightarrow \gamma s\bar{s}$	[h] < 1 × 10 ⁻³	CL=90%	DESIG=130

Lepton Family number (LF) violating modes

NODE=M049;CLUMP=C

Г ₁₂₇	$\mu^\pm\tau^\mp$	LF	< 6.0 × 10 ⁻⁶	CL=95%

DESIG=116

Other decays

 Γ_{128} invisible $< 3.0 \times 10^{-4}$ CL=90%

 NODE=M049;CLUMP=D
 DESIG=106
[a] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV

LINKAGE=E49

[b] $2 \text{ GeV} < m_{K^+K^-} < 3$ GeV

LINKAGE=G49

[c] $X = \text{scalar with } m < 8.0$ GeV

LINKAGE=A49

[d] $X\bar{X} = \text{vectors with } m < 3.1$ GeV

LINKAGE=B49

[e] X and $\bar{X} = \text{zero spin with } m < 4.5$ GeV

LINKAGE=F49

[f] $1.5 \text{ GeV} < m_X < 5.0$ GeV

LINKAGE=C49

[g] $201 \text{ MeV} < M(\mu^+\mu^-) < 3565$ MeV

LINKAGE=D49

[h] $0.5 \text{ GeV} < m_X < 9.0$ GeV, where m_X is the invariant mass of the hadronic final state.

LINKAGE=I49

 $\Upsilon(1S) \Gamma(i) \Gamma(e^+e^-) / \Gamma(\text{total})$

NODE=M049218

 $\Gamma(e^+e^-) \times \Gamma(\mu^+\mu^-) / \Gamma_{\text{total}}$ $\Gamma_2 \Gamma_3 / \Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
31.2±1.6±1.7	KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$

 NODE=M049G1
 NODE=M049G1
 $\Gamma(\text{hadrons}) \times \Gamma(e^+e^-) / \Gamma_{\text{total}}$ $\Gamma_0 \Gamma_2 / \Gamma$

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
1.240±0.016 OUR AVERAGE			
1.252±0.004±0.019	¹ ROSNER	06	CLEO $9.5 e^+e^- \rightarrow \text{hadrons}$
1.187±0.023±0.031	¹ BARU	92B	MD1 $e^+e^- \rightarrow \text{hadrons}$
1.23 ±0.02 ±0.05	¹ JAKUBOWSKI	88	CBAL $e^+e^- \rightarrow \text{hadrons}$
1.37 ±0.06 ±0.09	² GILES	84B	CLEO $e^+e^- \rightarrow \text{hadrons}$
1.23 ±0.08 ±0.04	² ALBRECHT	82	DASP $e^+e^- \rightarrow \text{hadrons}$
1.13 ±0.07 ±0.11	² NICZYPORUK	82	LENA $e^+e^- \rightarrow \text{hadrons}$
1.09 ±0.25	² BOCK	80	CNTR $e^+e^- \rightarrow \text{hadrons}$
1.35 ±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±0.018 OUR EVALUATION	

 NODE=M049W2
 NODE=M049W2
 → UNCHECKED ←
 $\Upsilon(1S)$ BRANCHING RATIOS

NODE=M049225

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.60±0.10 OUR AVERAGE				
2.53±0.13±0.05	60k	¹ BESSON	07	CLEO $e^+e^- \rightarrow \Upsilon(1S) \rightarrow \tau^+\tau^-$
2.61±0.12 ^{+0.09} _{-0.13}	25k	CINABRO	94B	CLE2 $e^+e^- \rightarrow \tau^+\tau^-$
2.7 ±0.4 ±0.2		² ALBRECHT	85C	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\tau^+\tau^-$
3.4 ±0.4 ±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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

NODE=M049R3;LINKAGE=BE

² Using $B(\Upsilon(1S) \rightarrow ee) = B(\Upsilon(1S) \rightarrow \mu\mu) = 0.0256$; not used for width evaluations.

NODE=M049R3;LINKAGE=A

 $\Gamma(e^+e^-) / \Gamma_{\text{total}}$ Γ_2 / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.38±0.11 OUR AVERAGE				
2.29±0.08±0.11		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.42±0.14±0.14	307	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
2.8 ±0.3 ±0.2	826	BESSON	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-e^+e^-$
5.1 ±3.0		BERGER	80C	PLUT $e^+e^- \rightarrow e^+e^-$

 NODE=M049R2
 NODE=M049R2

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$
 Γ_3/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0248±0.0005 OUR AVERAGE				
0.0249±0.0002±0.0007	345k	ADAMS	05	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0249±0.0008±0.0013		ALEXANDER	98	CLE2 $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.0212±0.0020±0.0010		¹ BARU	92	MD1 $e^+e^- \rightarrow \mu^+\mu^-$
0.0231±0.0012±0.0010		¹ KOBEL	92	CBAL $e^+e^- \rightarrow \mu^+\mu^-$
0.0252±0.0007±0.0007		CHEN	89B	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.0261±0.0009±0.0011		KAARSBERG	89	CSB2 $e^+e^- \rightarrow \mu^+\mu^-$
0.0230±0.0025±0.0013	86	ALBRECHT	87	ARG $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.029 ±0.003 ±0.002	864	BESSON	84	CLEO $\Upsilon(2S) \rightarrow \pi^+\pi^-\mu^+\mu^-$
0.027 ±0.003 ±0.003		ANDREWS	83	CLEO $e^+e^- \rightarrow \mu^+\mu^-$
0.032 ±0.013 ±0.003		ALBRECHT	82	DASP $e^+e^- \rightarrow \mu^+\mu^-$
0.038 ±0.015 ±0.002		NICZYPORUK	82	LENA $e^+e^- \rightarrow \mu^+\mu^-$
0.014 +0.034 -0.014		BOCK	80	CNTR $e^+e^- \rightarrow \mu^+\mu^-$
0.022 ±0.020		BERGER	79	PLUT $e^+e^- \rightarrow \mu^+\mu^-$

¹ Taking into account interference between the resonance and continuum.

NODE=M049R1
NODE=M049R1

NODE=M049R1;LINKAGE=G

 $\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$
 Γ_1/Γ_3

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
NODE=M049R43

NODE=M049R43;LINKAGE=DE

 $\Gamma(ggg)/\Gamma_{\text{total}}$
 Γ_4/Γ

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
NODE=M049R35

NODE=M049R35;LINKAGE=BE

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

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
NODE=M049R36

NODE=M049R36;LINKAGE=BE

 $\Gamma(\gamma gg)/\Gamma(ggg)$
 Γ_5/Γ_4

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
2.70±0.01±0.27	20M	BESSON	06A	CLEO $\Upsilon(1S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M049R37
NODE=M049R37

 $\Gamma(\eta'(958) \text{ anything})/\Gamma_{\text{total}}$
 Γ_6/Γ

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 $\Upsilon(1S) \rightarrow \eta' \text{ anything}$

NODE=M049R73
NODE=M049R73

 $\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$
 Γ_7/Γ

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
NODE=M049R12

NODE=M049R12;LINKAGE=K

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$					Γ_8/Γ	NODE=M049R85 NODE=M049R85
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.2 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$					Γ_9/Γ	NODE=M049R86 NODE=M049R86
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<3.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$					Γ_{10}/Γ	NODE=M049R87 NODE=M049R87
VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT		
$3.90 \pm 1.21 \pm 0.23$	20	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)\chi_{c2})/\Gamma_{\text{total}}$					Γ_{11}/Γ	NODE=M049R88 NODE=M049R88
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<1.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)\eta_c(2S))/\Gamma_{\text{total}}$					Γ_{12}/Γ	NODE=M049R89 NODE=M049R89
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<2.2 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)X(3940))/\Gamma_{\text{total}}$					Γ_{13}/Γ	NODE=M049R90 NODE=M049R90
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<5.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(J/\psi(1S)X(4160))/\Gamma_{\text{total}}$					Γ_{14}/Γ	NODE=M049R91 NODE=M049R91
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<5.4 \times 10^{-6}$	90	YANG	14	BELL	$e^+e^- \rightarrow J/\psi X$	
$\Gamma(X(4350) \text{ anything}, X \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$					Γ_{15}/Γ	NODE=M049P05 NODE=M049P05
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<8.1 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$	
$\Gamma(Z_c(3900)^\pm \text{ anything}, Z_c \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$					Γ_{16}/Γ	NODE=M049P06 NODE=M049P06
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<1.3 \times 10^{-5}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$	
$\Gamma(Z_c(4200)^\pm \text{ anything}, Z_c \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$					Γ_{17}/Γ	NODE=M049P07 NODE=M049P07
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<6.0 \times 10^{-5}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$	
$\Gamma(Z_c(4430)^\pm \text{ anything}, Z_c \rightarrow J/\psi(1S)\pi^\pm)/\Gamma_{\text{total}}$					Γ_{18}/Γ	NODE=M049P08 NODE=M049P08
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<4.9 \times 10^{-5}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi \pi^\pm X$	
$\Gamma(X_{cs}^\pm \text{ anything}, X \rightarrow J/\psi K^\pm)/\Gamma_{\text{total}}$					Γ_{19}/Γ	NODE=M049P11 NODE=M049P11
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<5.7 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^- X$	
$\Gamma(\psi(4260) \text{ anything}, \psi \rightarrow J/\psi(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$					Γ_{20}/Γ	NODE=M049R99 NODE=M049R99
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<3.8 \times 10^{-5}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi \pi^+\pi^- X$	
$\Gamma(\psi(4260) \text{ anything}, \psi \rightarrow J/\psi(1S)K^+K^-)/\Gamma_{\text{total}}$					Γ_{21}/Γ	NODE=M049P03 NODE=M049P03
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<7.5 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$	
$\Gamma(\chi_{c1}(4140) \text{ anything}, \chi_{c1} \rightarrow J/\psi(1S)\phi)/\Gamma_{\text{total}}$					Γ_{22}/Γ	NODE=M049P04 NODE=M049P04
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
$<5.2 \times 10^{-6}$	90	SHEN	16	BELL	$\Upsilon(1S) \rightarrow J/\psi K^+ K^- X$	
$\Gamma(\chi_{c0} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$					Γ_{23}/Γ_7	NODE=M049R25 NODE=M049R25
VALUE	CL%	DOCUMENT ID	TECN	COMMENT		
<7.4	90	BRIERE	04	CLEO	$e^+e^- \rightarrow J/\psi X$	

$\Gamma(\chi_{c1} \text{ anything})/\Gamma_{\text{total}}$ Γ_{24}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M049P13
NODE=M049P13**1.90±0.35 OUR FIT****1.90±0.43±0.14**

215

JIA

17

BELL

 $\Upsilon(1S) \rightarrow \gamma J/\psi(1S)$ $\Gamma(\chi_{c1} \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{24}/Γ_7

VALUE EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M049R26
NODE=M049R26**0.35±0.07 OUR FIT****0.35±0.08±0.06**

52 ± 12

BRIERE

04

CLEO

 $e^+e^- \rightarrow J/\psi X$ $\Gamma(\chi_{c1}(1P)\chi_{tetra})/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049P15
NODE=M049P15**<37.8 × 10⁻⁶**

90

¹ JIA

17A

BELL

 $e^+e^- \rightarrow \text{hadrons}$

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

NODE=M049R27
NODE=M049R27**0.52±0.12±0.09**

47 ± 11

BRIERE

04

CLEO

 $e^+e^- \rightarrow J/\psi X$ $\Gamma(\psi(2S) \text{ anything})/\Gamma_{\text{total}}$ Γ_{27}/Γ VALUE (units 10^{-4}) EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M049P12
NODE=M049P12**1.23±0.17±0.11**

215

SHEN

16

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S) \text{ anything})/\Gamma(J/\psi(1S) \text{ anything})$ Γ_{27}/Γ_7

VALUE EVTS

DOCUMENT ID

TECN

COMMENT

NODE=M049R28
NODE=M049R28**0.41±0.11±0.08**

42 ± 11

BRIERE

04

CLEO

 $e^+e^- \rightarrow J/\psi \pi^+ \pi^- X$ $\Gamma(\psi(2S)\eta_c)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R92
NODE=M049R92**<3.6 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)\chi_{c0})/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R93
NODE=M049R93**<6.5 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)\chi_{c1})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R94
NODE=M049R94**<4.5 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)\chi_{c2})/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R95
NODE=M049R95**<2.1 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)\eta_c(2S))/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R96
NODE=M049R96**<3.2 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)X(3940))/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R97
NODE=M049R97**<2.9 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(2S)X(4160))/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049R98
NODE=M049R98**<2.9 × 10⁻⁶**

90

YANG

14

BELL

 $e^+e^- \rightarrow \psi(2S) X$ $\Gamma(\psi(4260) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049P00
NODE=M049P00**<7.9 × 10⁻⁵**

90

SHEN

16

BELL

 $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$ $\Gamma(\psi(4360) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE CL%

DOCUMENT ID

TECN

COMMENT

NODE=M049P01
NODE=M049P01**<5.2 × 10⁻⁵**

90

SHEN

16

BELL

 $\Upsilon(1S) \rightarrow \psi(2S)\pi^+\pi^- X$

$\Gamma(\psi(4660) \text{ anything}, \psi \rightarrow \psi(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ 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

 $\Gamma(X(4050)^\pm \text{ anything}, X \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$ 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

 $\Gamma(Z_c(4430)^\pm \text{ anything}, Z_c \rightarrow \psi(2S)\pi^\pm)/\Gamma_{\text{total}}$ 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
$<2.6 \times 10^{-4}$	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 $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) = 3.6 \times 10^{-2}$.

NODE=M049P31;LINKAGE=A

 $\Gamma(Z_c(4200)^+ Z_c(4200)^-)/\Gamma_{\text{total}}$ 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 $B(Z_c(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1$.

NODE=M049P17;LINKAGE=A

 $\Gamma(Z_c(3900)^\pm Z_c(4200)^\mp)/\Gamma_{\text{total}}$ 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 $B(Z_c(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1 = B(Z_c(3900)^\pm \rightarrow J/\psi \pi^\pm)$.

NODE=M049P18;LINKAGE=A

 $\Gamma(Z_c(3900)^+ Z_c(3900)^-)/\Gamma_{\text{total}}$ 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 $B(Z_c(3900)^\pm \rightarrow J/\psi \pi^\pm) = 1$

NODE=M049P19;LINKAGE=A

 $\Gamma(X(4050)^+ X(4050)^-)/\Gamma_{\text{total}}$ 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 $B(X(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P20;LINKAGE=A

 $\Gamma(X(4250)^+ X(4250)^-)/\Gamma_{\text{total}}$ 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 $B(X(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1$

NODE=M049P21;LINKAGE=A

 $\Gamma(X(4050)^\pm X(4250)^\mp)/\Gamma_{\text{total}}$ 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 $B(X(4050)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm) = 1 = B(X(4250)^\pm \rightarrow \chi_{c1}(1P)\pi^\pm)$

NODE=M049P22;LINKAGE=A

 $\Gamma(Z_c(4430)^+ Z_c(4430)^-)/\Gamma_{\text{total}}$ 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 $B(Z_c(4430)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M049P23;LINKAGE=A

 $\Gamma(X(4055)^\pm X(4055)^\mp)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<23.3 \times 10^{-6}$	90	¹ JIA	18	BELL $\Upsilon(1S) \rightarrow \psi(2S)\pi^\pm X$

NODE=M049P25
NODE=M049P25

¹ Assuming $B(X(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1$

NODE=M049P25;LINKAGE=A

$\Gamma(X(4055)^\pm Z_c(4430)^\mp)/\Gamma_{\text{total}}$ 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 $B(X(4055)^\pm \rightarrow \psi(2S)\pi^\pm) = 1 = B(Z_c(4430)^\pm \rightarrow \psi(2S)\pi^\pm)$				

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

 $\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹ BARU	96 MD1	$\Upsilon(1S) \rightarrow \rho\bar{\rho}$

NODE=M049R59
 NODE=M049R59

¹ Supersedes BARU 92 in this node.

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

 $\Gamma(\rho(770) a_2(1320))/\Gamma_{\text{total}}$ Γ_{61}/Γ

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

$\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{62}/Γ

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

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{63}/Γ

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

 $\Gamma(K_1(1400)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{64}/Γ

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

 $\Gamma(b_1(1235)^\pm \pi^\mp)/\Gamma_{\text{total}}$ Γ_{65}/Γ

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

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

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

 $\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{67}/Γ

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

 $\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{68}/Γ

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

 $\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{69}/Γ

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

 $\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}}$ Γ_{70}/Γ

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

 $\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{71}/Γ

<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

 $\Gamma(f_1(1285) X_{\text{tetra}})/\Gamma_{\text{total}}$ Γ_{72}/Γ

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

 $\Gamma(\bar{2}H \text{ anything})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
2.85 ± 0.25 OUR AVERAGE				

NODE=M049R33
NODE=M049R33

$2.81 \pm 0.49^{+0.20}_{-0.24}$		LEES	14G	BABR $e^+ e^- \rightarrow \bar{2}H X$

OCCUR=2

$2.86 \pm 0.19 \pm 0.21$	455	ASNER	07	CLEO $e^+ e^- \rightarrow \bar{2}H X$

$\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.200±0.017	1,2 DOBBS 12A		$\Upsilon(1S) \rightarrow \text{hadrons}$

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.

NODE=M049R02;LINKAGE=DO

² Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M049R02;LINKAGE=NC

 $\Gamma(ggg, \gamma g g \rightarrow \bar{d} \text{ anything})/\Gamma(ggg, \gamma g g \rightarrow \text{anything})$

NODE=M049R34
 NODE=M049R34

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.36±0.23±0.25	455	ASNER	07	CLEO $e^+e^- \rightarrow \bar{d}X$

 $\Gamma(\gamma\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
6.3±1.2±1.3	¹ ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R70
 NODE=M049R70

¹ For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R70;LINKAGE=A

 $\Gamma(\gamma\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
1.7±0.6±0.3	¹ ANASTASSOV 99	CLE2	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R71
 NODE=M049R71

¹ For $m_{\pi\pi} > 1 \text{ GeV}$.

NODE=M049R71;LINKAGE=A

 $\Gamma(\gamma\pi\pi(\text{S-wave}))/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
4.63±0.56±0.48	LEES 18A	BABR	$\Upsilon(1S) \rightarrow \gamma\pi^+\pi^-$

NODE=M049P27
 NODE=M049P27

 $\Gamma(\gamma\pi^0\eta)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	¹ BESSON 07A	CLEO	$e^+e^- \rightarrow \Upsilon(1S)$

NODE=M049R47
 NODE=M049R47

¹ BESSON 07A obtained this limit for $0.7 < m_{\pi^0\eta} < 3 \text{ GeV}$.

NODE=M049R47;LINKAGE=BE

 $\Gamma(\gamma K^+K^-)/\Gamma_{\text{total}}$ Γ_{79}/Γ

($2 < m_{K^+K^-} < 3 \text{ GeV}$)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
1.14±0.08±0.10	90	ATHAR 06	CLE3	$\Upsilon(1S) \rightarrow \gamma K^+K^-$

NODE=M049R24
 NODE=M049R24
 NODE=M049R24

 $\Gamma(\gamma p\bar{p})/\Gamma_{\text{total}}$ Γ_{80}/Γ

($2 < m_{p\bar{p}} < 3 \text{ GeV}$)

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<0.6	90	ATHAR 06	CLE3	$\Upsilon(1S) \rightarrow \gamma p\bar{p}$

NODE=M049R29
 NODE=M049R29
 NODE=M049R29

 $\Gamma(\gamma 2h^+2h^-)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.0±1.1±1.0	80 ± 12	FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R20
 NODE=M049R20

 $\Gamma(\gamma 3h^+3h^-)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±1.5±1.3	39 ± 11	FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R21
 NODE=M049R21

 $\Gamma(\gamma 4h^+4h^-)/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.4±2.5±2.5	36 ± 12	FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R22
 NODE=M049R22

 $\Gamma(\gamma\pi^+\pi^-K^+K^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9±0.7±0.6	29 ± 8	FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R14
 NODE=M049R14

 $\Gamma(\gamma 2\pi^+2\pi^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5±0.7±0.5	26 ± 7	FULTON 90B	CLEO	$e^+e^- \rightarrow \text{hadrons}$

NODE=M049R13
 NODE=M049R13

$\Gamma(\gamma 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.5 \pm 0.9 \pm 0.8$	17 ± 5	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R17
 NODE=M049R17

 $\Gamma(\gamma 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.9 \pm 0.8$	18 ± 7	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R18
 NODE=M049R18

 $\Gamma(\gamma \pi^+ \pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.5 \pm 0.5 \pm 0.3$	22 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R15
 NODE=M049R15

 $\Gamma(\gamma 2\pi^+ 2\pi^- \rho \bar{\rho})/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.4 \pm 0.4 \pm 0.4$	7 ± 6	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R19
 NODE=M049R19

 $\Gamma(\gamma 2K^+ 2K^-)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-4})	EVTs	DOCUMENT ID	TECN	COMMENT
0.2 ± 0.2	2 ± 2	FULTON	90B CLEO	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M049R16
 NODE=M049R16

 $\Gamma(\gamma \eta'(958))/\Gamma_{\text{total}}$ Γ_{91}/Γ

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	$\Upsilon(1S) \rightarrow \gamma \eta' \rightarrow \gamma \eta \pi^+ \pi^-$

NODE=M049R55
 NODE=M049R55

 $\Gamma(\gamma \eta)/\Gamma_{\text{total}}$ Γ_{92}/Γ

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	$\Upsilon(1S) \rightarrow \gamma \eta$

NODE=M049R54
 NODE=M049R54

 $\Gamma(\gamma f_0(980))/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 3	90	¹ ATHAR	06 CLE3	$\Upsilon(1S) \rightarrow \gamma \pi^+ \pi^-$

¹ Assuming $B(f_0(980) \rightarrow \pi \pi) = 1$.

NODE=M049R31
 NODE=M049R31

NODE=M049R31;LINKAGE=AT

 $\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-5})	CL%	EVTs	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.6 OUR AVERAGE					
$2.13 \pm 0.28 \pm 0.72$			¹ LEES	18A BABR	$\Upsilon(1S) \rightarrow \gamma K^+ K^-$
$4.1 \pm 1.4 \pm 0.1$		17	² BESSON	11 CLEO	$\Upsilon(1S) \rightarrow K_S^0 K_S^0$
$3.7^{+0.9}_{-0.7} \pm 0.8$			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 $B(f'_2(1525) \rightarrow K \bar{K}) = (87.6 \pm 2.2) \times 10^{-2}$. 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
 NODE=M049R52

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 (CL = 90%) [$<5.7 \times 10^{-5}$ (CL = 90%) OUR 2020 BEST LIMIT]**<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

$\Gamma(\gamma\chi_{c0})/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.6 \times 10^{-5}$ (CL = 90%)		[$<6.5 \times 10^{-4}$ (CL = 90%) OUR 2020 BEST LIMIT]		
$<6.6 \times 10^{-5}$	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.				

NODE=M049R39
 NODE=M049R39

NODE=M049R39;LINKAGE=A

 $\Gamma(\gamma\chi_{c1})/\Gamma_{\text{total}}$ Γ_{113}/Γ

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.					

NODE=M049R40
 NODE=M049R40

NODE=M049R40;LINKAGE=A

 $\Gamma(\gamma\chi_{c2})/\Gamma_{\text{total}}$ Γ_{114}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.6 \times 10^{-6}$ (CL = 90%)		[$<7.6 \times 10^{-6}$ (CL = 90%) OUR 2020 BEST LIMIT]		
$<7.6 \times 10^{-6}$	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.				

NODE=M049R48
 NODE=M049R48

NODE=M049R48;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872))/\Gamma_{\text{total}}$ Γ_{115}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<4 \times 10^{-5}$	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 $B(\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi(1S)) = 3.6 \times 10^{-2}$.				

NODE=M049P32
 NODE=M049P32

NODE=M049P32;LINKAGE=A

 $\Gamma(\gamma\chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+\pi^-\pi^0 J/\psi)/\Gamma_{\text{total}}$ Γ_{116}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.8 \times 10^{-6}$ (CL = 90%)		[$<2.8 \times 10^{-6}$ (CL = 90%) OUR 2020 BEST LIMIT]		
$<2.8 \times 10^{-6}$	90	SHEN	10A	BELL $\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R68
 NODE=M049R68

 $\Gamma(\gamma X(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$ Γ_{117}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<3.0	90	SHEN	10A	BELL $\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R69
 NODE=M049R69

 $\Gamma(\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi)/\Gamma_{\text{total}}$ Γ_{118}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	SHEN	10A	BELL $\Upsilon(1S) \rightarrow \gamma X$

NODE=M049R74
 NODE=M049R74

 $\Gamma(\gamma X)/\Gamma_{\text{total}}$ Γ_{119}/Γ

(X = scalar with $m < 8.0$ GeV)				
VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 4.5	90	¹ DEL-AMO-SA..11J	BABR	$e^+e^- \rightarrow \gamma + X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<30	90	² BALEST	95	CLEO $e^+e^- \rightarrow \gamma + X$
¹ For a noninteracting scalar X with mass $m < 8.0$ GeV.				
² For a noninteracting pseudoscalar X with mass < 7.2 GeV.				

NODE=M049R60
 NODE=M049R60
 NODE=M049R60

NODE=M049R60;LINKAGE=DA
 NODE=M049R60;LINKAGE=A

 $\Gamma(\gamma X \bar{X}(m_X < 3.1 \text{ GeV}))/\Gamma_{\text{total}}$ Γ_{120}/Γ

(X $\bar{X}$ = vectors with $m < 3.1$ GeV)				
VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
<1	90	¹ BALEST	95	CLEO $e^+e^- \rightarrow \gamma + X \bar{X}$
¹ For a noninteracting vector X with mass < 3.1 GeV.				

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 $m < 4.5 \text{ GeV}$ Γ_{121}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	¹ DEL-AMO-SA..11J	BABR	$e^+e^- \rightarrow \gamma + X \bar{X}$

¹ For a noninteracting scalar X with mass $m < 4.5 \text{ GeV}$.

NODE=M049R01

NODE=M049R01
NODE=M049R01

NODE=M049R01;LINKAGE=DA

 $\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ $(1.5 \text{ GeV} < m_X < 5.0 \text{ GeV})$ Γ_{122}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.78	95	ROSNER	07A CLEO	$e^+e^- \rightarrow \gamma X$

NODE=M049R64

NODE=M049R64
NODE=M049R64 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ $(201 < M(\mu^+ \mu^-) < 3565 \text{ MeV})$ Γ_{123}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<9	90	¹ LOVE	08 CLEO	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

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

<9.7	90	² LEES	13C BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar a_1^0 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_1^0 with mass in the range 212–9200 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from $0.28-9.7 \times 10^{-6}$.

NODE=M049R65

NODE=M049R65
NODE=M049R65

NODE=M049R65;LINKAGE=LO

NODE=M049R65;LINKAGE=LE

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ $(2m_\tau < M(\tau^+ \tau^-) < 9.2 \text{ GeV})$ Γ_{124}/Γ

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. • • •

< 50	90	² LOVE	08 CLEO	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

¹ For a narrow scalar a_1^0 with $2m_\tau < M(a_1^0) < 9.2 \text{ GeV}$, which result in a 90% CL upper limits of 0.9×10^{-5} at $M(a_1^0) = 2m_\tau$, $\approx 1.5 \times 10^{-5}$ at $M(a_1^0) = 7.5 \text{ GeV}$, and 13×10^{-5} at $M(a_1^0) = 9.2 \text{ GeV}$.² For a narrow scalar or pseudoscalar a_1^0 with $2m_\tau < M(a_1^0) < 7.5 \text{ GeV}$, which result in a 90% CL limits ranging from 1×10^{-5} at $M(a_1^0)=2m_\tau$ to 5×10^{-5} at $M(a_1^0)=7.5 \text{ GeV}$.

NODE=M049R66

NODE=M049R66
NODE=M049R66

NODE=M049R66;LINKAGE=A

NODE=M049R66;LINKAGE=LO

 $\Gamma(\gamma a_1^0 \rightarrow \gamma g g)/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$ Γ_{125}/Γ

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_1^0 searched for in 26 hadronic decay modes with invariant mass $0.5 \text{ GeV} < m_X < 9.0 \text{ GeV}$. Measured 90% CL limit as a function of m_X range from 10^{-6} to 10^{-2} .

NODE=M049R03

NODE=M049R03
NODE=M049R03

NODE=M049R03;LINKAGE=A

 $\Gamma(\gamma a_1^0 \rightarrow \gamma s \bar{s})/\Gamma_{\text{total}}$ $(0.5 \text{ GeV} < m < 9.0 \text{ GeV})$ Γ_{126}/Γ

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_1^0 searched for in 14 hadronic decay modes with invariant mass $1.5 \text{ GeV} < m_X < 9.0 \text{ GeV}$. Measured 90% CL limit as a function of m_X range from 10^{-5} to 10^{-3} .

NODE=M049R04

NODE=M049R04
NODE=M049R04

NODE=M049R04;LINKAGE=A

LEPTON FAMILY NUMBER (LF) VIOLATING MODES

NODE=M049230

 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{127}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<6.0	95	LOVE	08A CLEO	$e^+e^- \rightarrow \mu^\pm \tau^\mp$

NODE=M049R67

NODE=M049R67

OTHER DECAYS

 $\Gamma(\text{invisible})/\Gamma_{\text{total}}$ Γ_{128}/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

NODE=M049

KATRENKO	20	PRL 124 122001	P. Katrenko <i>et al.</i>	(BELLE Collab.)
JIA	18	PR D97 112004	S. Jia <i>et al.</i>	(BELLE Collab.)
LEES	18A	PR D97 112006	J.P. Lees <i>et al.</i>	(BABAR Collab.)
JIA	17	PR D95 012001	S. Jia <i>et al.</i>	(BELLE Collab.)
JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)
SHEN	16	PR D93 112013	C.P. Shen <i>et al.</i>	(BELLE Collab.)
LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
YANG	14	PR D90 112008	S.D. Yang <i>et al.</i>	(BELLE Collab.)
LEES	13C	PR D87 031102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13L	PR D88 031701	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	13R	PR D88 071102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	13	PR D88 011102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
DOBBS	12A	PR D86 052003	S. Dobbs <i>et al.</i>	
SHEN	12A	PR D86 031102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
BESSION	11	PR D83 037101	D. Besson <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	11J	PRL 107 021804	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
AUBERT	10C	PR D81 011102	B. Aubert <i>et al.</i>	(BABAR Collab.)
DEL-AMO-SA...	10C	PRL 104 191801	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
SHEN	10A	PR D82 051504	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AUBERT	09AX	PRL 103 251801	B. Aubert <i>et al.</i>	(BABAR Collab.)
LOVE	08	PRL 101 151802	W. Love <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.)
ATHAR	07A	PR D76 072003	S.B. Athar <i>et al.</i>	(CLEO Collab.)
BESSION	07	PRL 98 052002	D. Besson <i>et al.</i>	(CLEO Collab.)
BESSION	07A	PR D75 072001	D. Besson <i>et al.</i>	(CLEO Collab.)
ROSNER	07A	PR D76 117102	J.L. Rosner <i>et al.</i>	(CLEO Collab.)
RUBIN	07	PR D75 031104	P. Rubin <i>et al.</i>	(CLEO Collab.)
TAJIMA	07	PRL 98 132001	O. Tajima <i>et al.</i>	(BELLE Collab.)
AQUINES	06A	PR D74 092006	O. Aquines <i>et al.</i>	(CLEO Collab.)
ATHAR	06	PR D73 032001	S.B. Athar <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.)
BRIERE	04	PR D70 072001	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	03	PR D67 052003	M. Artuso <i>et al.</i>	(CLEO Collab.)
MASEK	02	PR D65 072002	G. Masek <i>et al.</i>	(CLEO Collab.)
RICHICHI	01B	PRL 87 141801	S.J. Richichi <i>et al.</i>	(CLEO Collab.)
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>	
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.)
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	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)
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.)

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REFID=22264

REFID=22259

$\chi_{b0}(1P)$

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

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

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

NODE=M076M

→ UNCHECKED ←

$$m_{\chi_{b1}(1P)} - m_{\chi_{b0}(1P)}$$

VALUE (MeV)

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

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

162.5 ± 0.4 OUR AVERAGE

162.56 ± 0.19 ± 0.42

162.0 ± 0.8 ± 1.2

162.1 ± 0.5 ± 1.4

163.8 ± 1.6 ± 2.7

158.0 ± 7 ± 1

• • • 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

NODE=M076DM

 $\chi_{b0}(1P)$ DECAY MODES

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 × 10 ⁻⁴	90%
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.1 × 10 ⁻⁴	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) × 10 ⁻⁴	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 × 10 ⁻⁴	90%
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 × 10 ⁻⁴	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	< 6 × 10 ⁻⁴	90%
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	(2.4 ± 1.2) × 10 ⁻⁴	
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 × 10 ⁻³	90%
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	< 2.1 × 10 ⁻³	90%
$\Gamma_{17} \quad J/\psi J/\psi$	< 7 × 10 ⁻⁵	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	< 1.2 × 10 ⁻⁴	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	< 3.1 × 10 ⁻⁵	90%
$\Gamma_{20} \quad J/\psi(1S) \text{ anything}$	< 2.3 × 10 ⁻³	90%

NODE=M076215;NODE=M076

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

$$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma$$

VALUE (%)

CL% EVTS

DOCUMENT ID

TECN

COMMENT

1.94 ± 0.27 OUR AVERAGE

2.07 ± 0.24 ± 0.21

1.76 ± 0.30 ± 0.18

87

1,2 LEES

14M

BABR

 $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$

3,4 KORNICER

11

CLEO

 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

NODE=M076220

NODE=M076R1

NODE=M076R1

• • • 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

$\Gamma(D^0X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<10.4 × 10 ⁻²	90	6,7 BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0X$

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%	DOCUMENT ID	TECN	COMMENT
<1.6	90	⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 6×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) =$
 3.8×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 2×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) =$
 3.8×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow$
 $\gamma\chi_{b0}(1P))]$ < 18×10^{-6} which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) =$
 3.8×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$
 < 8×10^{-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)	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.6±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 $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 10×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 20×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 6×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 3×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 22×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 37×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 3×10^{-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 $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ < 77×10^{-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

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$$

$$\Gamma_1/\Gamma \times \Gamma_{61}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

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

 $B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

NODE=M076B01
 NODE=M076B01

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.67$\pm$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 $\pm$ 0.24 $\pm$ 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.				

NODE=M076B01;LINKAGE=A

$$[B(\chi_{b0}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$$

NODE=M076A01
 NODE=M076A01

VALUE (%)	DOCUMENT ID	TECN	COMMENT
3.28$\pm$0.37	27 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$
27 From a sample of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ without converted photons.			

NODE=M076A01;LINKAGE=A

 $\chi_{b0}(1P)$ REFERENCES

NODE=M076

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+)

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

$\chi_{b1}(1P)$

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

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

NODE=M077

 $\chi_{b1}(1P)$ MASS

NODE=M077M

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

→ UNCHECKED ←

 γ ENERGY IN $\Upsilon(2S)$ DECAY

NODE=M077DM

NODE=M077DM

VALUE (MeV)

DOCUMENT ID

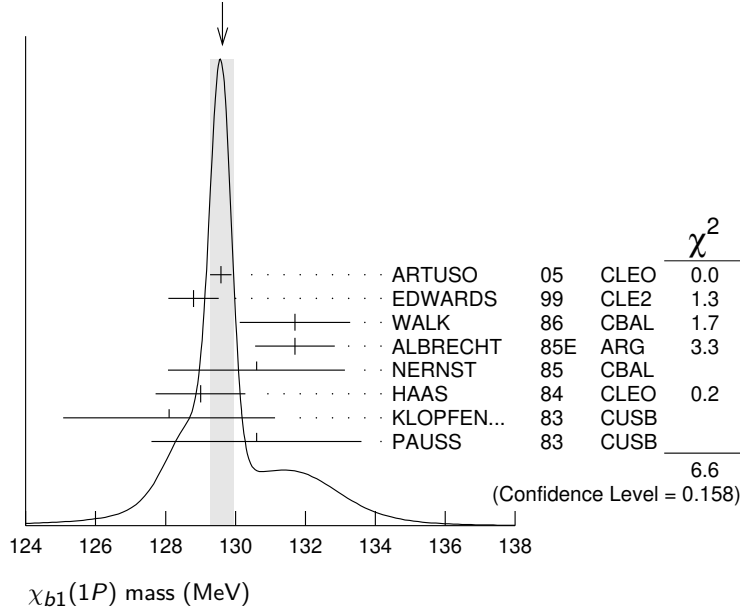
TECN

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	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

WEIGHTED AVERAGE
129.63 ± 0.33 (Error scaled by 1.3)

 **$\chi_{b1}(1P)$ DECAY MODES**

NODE=M077215;NODE=M077

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(35.2 ± 2.0) %	DESIG=1
$\Gamma_2 \quad D^0 X$	(12.6 ± 2.2) %	DESIG=2
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	(2.0 ± 0.6) × 10 ⁻⁴	DESIG=3
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	(1.3 ± 0.5) × 10 ⁻⁴	DESIG=4
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 × 10 ⁻⁴	90% DESIG=5
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	(8.0 ± 2.5) × 10 ⁻⁴	DESIG=6
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.5 ± 0.5) × 10 ⁻⁴	DESIG=7
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5 ± 1.2) × 10 ⁻⁴	DESIG=8
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6 ± 3.2) × 10 ⁻⁴	DESIG=9
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	(9.3 ± 3.3) × 10 ⁻⁴	DESIG=10
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	(1.9 ± 0.6) × 10 ⁻⁴	DESIG=11

Γ_{12}	$3\pi^+ 3\pi^- 2\pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$		DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- K^+ K^-$	$(2.6 \pm 0.8) \times 10^{-4}$		DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5 \pm 2.6) \times 10^{-4}$		DESIG=14
Γ_{15}	$4\pi^+ 4\pi^-$	$(2.6 \pm 0.9) \times 10^{-4}$		DESIG=15
Γ_{16}	$4\pi^+ 4\pi^- 2\pi^0$	$(1.4 \pm 0.6) \times 10^{-3}$		DESIG=16
Γ_{17}	ω anything	$(4.9 \pm 1.4) \%$		DESIG=21
Γ_{18}	ωX_{tetra}	$< 4.44 \times 10^{-4}$	90%	DESIG=22
Γ_{19}	$J/\psi J/\psi$	$< 2.7 \times 10^{-5}$	90%	DESIG=17
Γ_{20}	$J/\psi \psi(2S)$	$< 1.7 \times 10^{-5}$	90%	DESIG=18
Γ_{21}	$\psi(2S) \psi(2S)$	$< 6 \times 10^{-5}$	90%	DESIG=19
Γ_{22}	$J/\psi(1S)$ anything	$< 1.1 \times 10^{-3}$	90%	DESIG=20
Γ_{23}	$J/\psi(1S) X_{tetra}$	$< 2.27 \times 10^{-4}$	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 $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.45 \pm 0.02 \pm 0.11 \pm 0.15) \times 10^{-2}$ 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.

NODE=M077R1;LINKAGE=J

² LEES 14M quotes $\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{total} = (2.51 \pm 0.12) \%$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma \gamma \mu^+ \mu^-$ with and without converted photons.

NODE=M077R1;LINKAGE=B

³ LEES 14M reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (2.51 \pm 0.12) \times 10^{-2}$ 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.

NODE=M077R1;LINKAGE=D

⁴ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

⁵ KORNICER 11 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$ 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.

NODE=M077R1;LINKAGE=KA
NODE=M077R1;LINKAGE=KR

⁶ LEES 11J reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$ 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.

NODE=M077R1;LINKAGE=LE

⁷ WALK 86 quotes $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.8 \pm 0.9 \pm 0.7) \%$.

NODE=M077R1;LINKAGE=A

⁸ WALK 86 reports $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (23.4 \pm 3.63 \pm 2.82) \times 10^{-3}$ 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=C

 $\Gamma(D^0 X)/\Gamma_{total}$ **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

 $\Gamma(\pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{total}$ **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 $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{total}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (14 \pm 3 \pm 3) \times 10^{-6}$ 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	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

NODE=M077R03
 NODE=M077R03

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;LINKAGE=AS

 $\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

NODE=M077R04
 NODE=M077R04

¹ ASNER 08A reports $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))] < 42 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

NODE=M077R04;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	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

NODE=M077R05
 NODE=M077R05

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;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	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

NODE=M077R06
 NODE=M077R06

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;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	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

NODE=M077R07
 NODE=M077R07

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;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	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$

NODE=M077R08
 NODE=M077R08

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;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	$\Upsilon(2S) \rightarrow \gamma 3\pi^+2\pi^-K^-K_S^0\pi^0$

NODE=M077R09
 NODE=M077R09

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;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	$\Upsilon(2S) \rightarrow \gamma 3\pi^+3\pi^-$

NODE=M077R10
 NODE=M077R10

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;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
$17 \pm 5 \pm 1$	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
$2.6 \pm 0.8 \pm 0.1$	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
$7.5 \pm 2.6 \pm 0.4$	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

 $\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

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.

NODE=M077R14
 NODE=M077R14

NODE=M077R14;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
$14 \pm 5 \pm 1$	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.

NODE=M077R15
 NODE=M077R15

NODE=M077R15;LINKAGE=AS

 $\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 1.3 \pm 0.6$	51k	JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

NODE=M077R19
 NODE=M077R19

 $\Gamma(\omega X_{\text{tetra}})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 44.4 \times 10^{-5}$	90	¹ JIA	17A BELL	$e^+ e^- \rightarrow \text{hadrons}$

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
 NODE=M077R23

NODE=M077R23;LINKAGE=A

 $\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 2.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

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
 NODE=M077R16

NODE=M077R16;LINKAGE=SH

 $\Gamma(J/\psi \psi(2S))/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
< 1.7	90	¹ SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma \psi X$

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
 NODE=M077R17

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	$\Upsilon(2S) \rightarrow \gamma\psi X$
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 $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$.				

 Γ_{21}/Γ

NODE=M077R18
 NODE=M077R18

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

$$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}} \times \Gamma_1/\Gamma \times \Gamma_{59}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$$

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$\pm$0.34 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.			

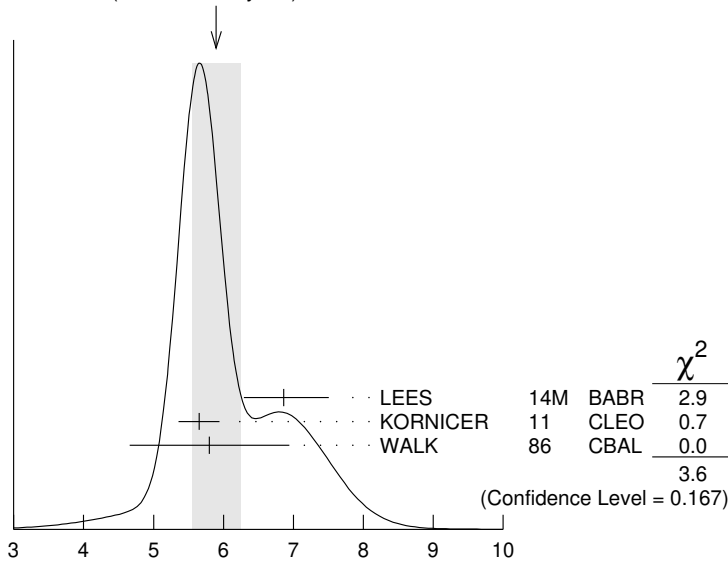
NODE=M077B01
 NODE=M077B01

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;LINKAGE=A

WEIGHTED AVERAGE
 5.90 $\pm$ 0.34 (Error scaled by 1.3)



$$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$$

(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$\pm$0.34 OUR AVERAGE				

NODE=M077B02
 NODE=M077B02

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;LINKAGE=A

$B(\chi_{b2}(1P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(1P) \rightarrow pX + \bar{p}X)$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.068 \pm 0.010 \pm 0.040$	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

NODE=M077R20
NODE=M077R20

 $B(\chi_{b0}(1P) \rightarrow pX + \bar{p}X)/B(\chi_{b1}(1P) \rightarrow pX + \bar{p}X)$

VALUE	DOCUMENT ID	TECN	COMMENT
$1.11 \pm 0.15 \pm 0.20$	BRIERE	07	CLEO $\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

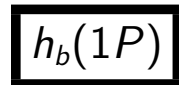
NODE=M077R21
NODE=M077R21

 $\chi_{b1}(1P)$ 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. Klopstein <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
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REFID=46612
REFID=40019
REFID=22290
REFID=22288
REFID=22289
REFID=22287
REFID=22285
REFID=22286



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

Quantum numbers are quark model predictions, $C = -$ established by $\eta_b \gamma$ decay.

NODE=M204

NODE=M204

 $h_b(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
9899.3 ± 0.8 OUR AVERAGE				
$9899.3 \pm 0.4 \pm 1.0$	112k	TAMPONI	15	BELL $e^+e^- \rightarrow \gamma \eta + \text{hadrons}$
$9899.1 \pm 0.4 \pm 1.0$	70k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^- \text{hadrons}$
$9902 \pm 4 \pm 2$	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.

NODE=M204M

NODE=M204M

NODE=M204M;LINKAGE=AD

 $h_b(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \eta_b(1S) \gamma$	$(52^{+6}_{-5}) \%$

NODE=M204215;NODE=M204

DESIG=1

 $h_b(1P)$ 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 $B(\eta \rightarrow 2\gamma) = (39.41 \pm 0.20)\%$.

NODE=M204225

NODE=M204R01
NODE=M204R01

NODE=M204R01;LINKAGE=A

 $h_b(1P)$ 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.)

NODE=M204

REFID=56996
REFID=53962
REFID=54718
REFID=53937

$\chi_{b2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

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 ± 0.26 ± 0.31 OUR EVALUATION From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

NODE=M078M

→ UNCHECKED ←

 $m_{\chi_{b2}(1P)} - m_{\chi_{b1}(1P)}$

NODE=M078DM2

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

19.10 ± 0.25 OUR AVERAGE Error includes scale factor of 1.1.

19.81 ± 0.65 ± 0.20

¹ AAIJ

14BG LHCb

 $pp \rightarrow \gamma \mu^+ \mu^- X$

19.01 ± 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 ± 0.29 OUR AVERAGE Error includes scale factor of 1.1.

110.58 ± 0.08 ± 0.30

ARTUSO

05

CLEO

 $\Upsilon(2S) \rightarrow \gamma X$

110.8 ± 0.3 ± 0.6

EDWARDS

99

CLE2

 $\Upsilon(2S) \rightarrow \gamma \chi(1P)$

107.0 ± 1.1 ± 1.3

WALK

86

CBAL

 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

110.6 ± 0.3 ± 0.9

ALBRECHT

85E

ARG

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$

110.4 ± 0.8 ± 2.2

NERNST

85

CBAL

 $\Upsilon(2S) \rightarrow \gamma X$

109.5 ± 0.7 ± 1.0

HAAS

84

CLEO

 $\Upsilon(2S) \rightarrow \text{conv.} \gamma X$

108.2 ± 0.3 ± 2.0

KLOPFEN...

83

CUSB

 $\Upsilon(2S) \rightarrow \gamma X$

108.8 ± 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
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(18.0 ± 1.0) %	
$\Gamma_2 \quad D^0 X$	< 7.9 %	90%
$\Gamma_3 \quad \pi^+ \pi^- K^+ K^- \pi^0$	(8 ± 5) × 10 ⁻⁵	
$\Gamma_4 \quad 2\pi^+ \pi^- K^- K_S^0$	< 1.0 × 10 ⁻⁴	90%
$\Gamma_5 \quad 2\pi^+ \pi^- K^- K_S^0 2\pi^0$	(5.3 ± 2.4) × 10 ⁻⁴	
$\Gamma_6 \quad 2\pi^+ 2\pi^- 2\pi^0$	(3.5 ± 1.4) × 10 ⁻⁴	
$\Gamma_7 \quad 2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.4) × 10 ⁻⁴	
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.1 ± 0.9) × 10 ⁻⁴	
$\Gamma_9 \quad 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(3.9 ± 1.8) × 10 ⁻⁴	
$\Gamma_{10} \quad 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 5 × 10 ⁻⁴	90%
$\Gamma_{11} \quad 3\pi^+ 3\pi^-$	(7.0 ± 3.1) × 10 ⁻⁵	
$\Gamma_{12} \quad 3\pi^+ 3\pi^- 2\pi^0$	(1.0 ± 0.4) × 10 ⁻³	
$\Gamma_{13} \quad 3\pi^+ 3\pi^- K^+ K^-$	< 8 × 10 ⁻⁵	90%
$\Gamma_{14} \quad 3\pi^+ 3\pi^- K^+ K^- \pi^0$	(3.6 ± 1.5) × 10 ⁻⁴	
$\Gamma_{15} \quad 4\pi^+ 4\pi^-$	(8 ± 4) × 10 ⁻⁵	
$\Gamma_{16} \quad 4\pi^+ 4\pi^- 2\pi^0$	(1.8 ± 0.7) × 10 ⁻³	
$\Gamma_{17} \quad J/\psi J/\psi$	< 4 × 10 ⁻⁵	90%
$\Gamma_{18} \quad J/\psi \psi(2S)$	< 5 × 10 ⁻⁵	90%
$\Gamma_{19} \quad \psi(2S) \psi(2S)$	< 1.6 × 10 ⁻⁵	90%
$\Gamma_{20} \quad J/\psi(1S) \text{anything}$	(1.5 ± 0.4) × 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

NODE=M078220

 $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ NODE=M078R1
NODE=M078R1

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.180±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 ± 0.05		KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

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 NODE=M078R01
NODE=M078R01

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.9 \times 10^{-2}$	90	^{1,2} BRIERE	08 CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$

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 NODE=M078R02
NODE=M078R02

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.84 \pm 0.50 \pm 0.04$	8	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

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 NODE=M078R03
NODE=M078R03

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.0	90	¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

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

 $\Gamma(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$
 $\Gamma_1/\Gamma \times \Gamma_{60}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$

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 $\pm$ 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. **$[B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$**

VALUE (%)	DOCUMENT ID	TECN	COMMENT

55.6$\pm$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. **$B(\chi_{b2}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$**

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

3.8 $\pm$ 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. **$\chi_{b2}(1P)$ 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+)

 $\eta_b(2S)$

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

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

 $\eta_b(2S)$ MASS

VALUE (MeV)	EVTs	DOCUMENT ID	TECN	COMMENT

9999.0$\pm 3.5^{+2.8}_{-1.9}$	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 $\pm 2.3 \pm 2.1$	11 $\pm$ 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.

$$m_{\Upsilon(2S)} - m_{\eta_b(2S)}$$

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

$\Upsilon(2S)$

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

NODE=M052

 $\Upsilon(2S)$ MASS

NODE=M052M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10023.26±0.31 OUR AVERAGE			
10023.5 ±0.5	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
10023.1 ±0.4	BARBER 84	REDE	$e^+e^- \rightarrow \text{hadrons}$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
10023.6 ±0.5	^{2,3} BARU 86B	REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 86B using new electron mass (COHEN 87).			
² Reanalysis of ARTAMONOV 84.			
³ Superseded by ARTAMONOV 00.			

NODE=M052M

NODE=M052M;LINKAGE=AR
 NODE=M052M;LINKAGE=C
 NODE=M052M;LINKAGE=RZ

 $m\Upsilon(3S) - m\Upsilon(2S)$

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 × 10 ⁻⁵	CL=90%	DESIG=10
$\Gamma_7 \quad \Upsilon(1S)\eta$	(2.9 ± 0.4) × 10 ⁻⁴	S=2.0	DESIG=6
$\Gamma_8 \quad J/\psi(1S) \text{ anything}$	< 6 × 10 ⁻³	CL=90%	DESIG=20
$\Gamma_9 \quad J/\psi(1S)\eta_c$	< 5.4 × 10 ⁻⁶	CL=90%	DESIG=143
$\Gamma_{10} \quad J/\psi(1S)\chi_{c0}$	< 3.4 × 10 ⁻⁶	CL=90%	DESIG=144
$\Gamma_{11} \quad J/\psi(1S)\chi_{c1}$	< 1.2 × 10 ⁻⁶	CL=90%	DESIG=145
$\Gamma_{12} \quad J/\psi(1S)\chi_{c2}$	< 2.0 × 10 ⁻⁶	CL=90%	DESIG=146
$\Gamma_{13} \quad J/\psi(1S)\eta_c(2S)$	< 2.5 × 10 ⁻⁶	CL=90%	DESIG=147
$\Gamma_{14} \quad J/\psi(1S)X(3940)$	< 2.0 × 10 ⁻⁶	CL=90%	DESIG=148
$\Gamma_{15} \quad J/\psi(1S)X(4160)$	< 2.0 × 10 ⁻⁶	CL=90%	DESIG=149
$\Gamma_{16} \quad \chi_{c1} \text{ anything}$	(2.2 ± 0.5) × 10 ⁻⁴		DESIG=157
$\Gamma_{17} \quad \chi_{c1}(1P)^0 X_{tetra}$	< 3.67 × 10 ⁻⁵	CL=90%	DESIG=160
$\Gamma_{18} \quad \chi_{c2} \text{ anything}$	(2.3 ± 0.8) × 10 ⁻⁴		DESIG=158
$\Gamma_{19} \quad \psi(2S)\eta_c$	< 5.1 × 10 ⁻⁶	CL=90%	DESIG=150
$\Gamma_{20} \quad \psi(2S)\chi_{c0}$	< 4.7 × 10 ⁻⁶	CL=90%	DESIG=151
$\Gamma_{21} \quad \psi(2S)\chi_{c1}$	< 2.5 × 10 ⁻⁶	CL=90%	DESIG=152
$\Gamma_{22} \quad \psi(2S)\chi_{c2}$	< 1.9 × 10 ⁻⁶	CL=90%	DESIG=153
$\Gamma_{23} \quad \psi(2S)\eta_c(2S)$	< 3.3 × 10 ⁻⁶	CL=90%	DESIG=154
$\Gamma_{24} \quad \psi(2S)X(3940)$	< 3.9 × 10 ⁻⁶	CL=90%	DESIG=155
$\Gamma_{25} \quad \psi(2S)X(4160)$	< 3.9 × 10 ⁻⁶	CL=90%	DESIG=156
$\Gamma_{26} \quad Z_c(3900)^+ Z_c(3900)^-$	< 1.0 × 10 ⁻⁶	CL=90%	DESIG=162
$\Gamma_{27} \quad Z_c(4200)^+ Z_c(4200)^-$	< 1.67 × 10 ⁻⁵	CL=90%	DESIG=163
$\Gamma_{28} \quad Z_c(3900)^\pm Z_c(4200)^\mp$	< 7.3 × 10 ⁻⁶	CL=90%	DESIG=164
$\Gamma_{29} \quad X(4050)^+ X(4050)^-$	< 1.35 × 10 ⁻⁵	CL=90%	DESIG=165

Г30	$X(4250)^+ X(4250)^-$	$< 2.67 \times 10^{-5}$	CL=90%	DESIG=166
Г31	$X(4050)^\pm X(4250)^\mp$	$< 2.72 \times 10^{-5}$	CL=90%	DESIG=167
Г32	$Z_c(4430)^+ Z_c(4430)^-$	$< 2.03 \times 10^{-5}$	CL=90%	DESIG=168
Г33	$X(4055)^\pm X(4055)^\mp$	$< 1.11 \times 10^{-5}$	CL=90%	DESIG=170
Г34	$X(4055)^\pm Z_c(4430)^\mp$	$< 2.11 \times 10^{-5}$	CL=90%	DESIG=171
Г35	$\overline{2H}$ anything	$(2.78^{+0.30}_{-0.26}) \times 10^{-5}$	S=1.2	DESIG=16
Г36	hadrons	$(94 \pm 11) \%$		DESIG=101
Г37	$g g g$	$(58.8 \pm 1.2) \%$		DESIG=105
Г38	$\gamma g g$	$(1.87 \pm 0.28) \%$		DESIG=106
Г39	$\phi K^+ K^-$	$(1.6 \pm 0.4) \times 10^{-6}$		DESIG=133
Г40	$\omega \pi^+ \pi^-$	$< 2.58 \times 10^{-6}$	CL=90%	DESIG=134
Г41	$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(2.3 \pm 0.7) \times 10^{-6}$		DESIG=135
Г42	$\phi f'_2(1525)$	$< 1.33 \times 10^{-6}$	CL=90%	DESIG=136
Г43	$\omega f_2(1270)$	$< 5.7 \times 10^{-7}$	CL=90%	DESIG=137
Г44	$\rho(770) a_2(1320)$	$< 8.8 \times 10^{-7}$	CL=90%	DESIG=138
Г45	$K^*(892)^0 \overline{K}_2^*(1430)^0 + \text{c.c.}$	$(1.5 \pm 0.6) \times 10^{-6}$		DESIG=139
Г46	$K_1(1270)^\pm K^\mp$	$< 3.22 \times 10^{-6}$	CL=90%	DESIG=140
Г47	$K_1(1400)^\pm K^\mp$	$< 8.3 \times 10^{-7}$	CL=90%	DESIG=141
Г48	$b_1(1235)^\pm \pi^\mp$	$< 4.0 \times 10^{-7}$	CL=90%	DESIG=142
Г49	$\rho \pi$	$< 1.16 \times 10^{-6}$	CL=90%	DESIG=126
Г50	$\pi^+ \pi^- \pi^0$	$< 8.0 \times 10^{-7}$	CL=90%	DESIG=127
Г51	$\omega \pi^0$	$< 1.63 \times 10^{-6}$	CL=90%	DESIG=128
Г52	$\pi^+ \pi^- \pi^0 \pi^0$	$(1.30 \pm 0.28) \times 10^{-5}$		DESIG=129
Г53	$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.14 \pm 0.33) \times 10^{-6}$		DESIG=130
Г54	$K^*(892)^0 \overline{K}^0 + \text{c.c.}$	$< 4.22 \times 10^{-6}$	CL=90%	DESIG=131
Г55	$K^*(892)^- K^+ + \text{c.c.}$	$< 1.45 \times 10^{-6}$	CL=90%	DESIG=132
Г56	$f_1(1285)$ anything	$(2.2 \pm 1.6) \times 10^{-3}$		DESIG=159
Г57	$f_1(1285) X_{tetra}$	$< 6.47 \times 10^{-5}$	CL=90%	DESIG=161
Г58	Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$		DESIG=121

Radiative decays

NODE=M052;CLUMP=A

Г59	$\gamma \chi_{b1}(1P)$	$(6.9 \pm 0.4) \%$		DESIG=8
Г60	$\gamma \chi_{b2}(1P)$	$(7.15 \pm 0.35) \%$		DESIG=7
Г61	$\gamma \chi_{b0}(1P)$	$(3.8 \pm 0.4) \%$		DESIG=9
Г62	$\gamma f_0(1710)$	$< 5.9 \times 10^{-4}$	CL=90%	DESIG=13
Г63	$\gamma f'_2(1525)$	$< 5.3 \times 10^{-4}$	CL=90%	DESIG=12
Г64	$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	CL=90%	DESIG=11
Г65	$\gamma f_J(2220)$			DESIG=14
Г66	$\gamma \eta_c(1S)$	$< 2.7 \times 10^{-5}$	CL=90%	DESIG=111
Г67	$\gamma \chi_{c0}$	$< 1.0 \times 10^{-4}$	CL=90%	DESIG=112
Г68	$\gamma \chi_{c1}$	$< 3.6 \times 10^{-6}$	CL=90%	DESIG=113
Г69	$\gamma \chi_{c2}$	$< 1.5 \times 10^{-5}$	CL=90%	DESIG=114
Г70	$\gamma \chi_{c1}(3872)$	$< 2.1 \times 10^{-5}$	CL=90%	DESIG=172
Г71	$\gamma \chi_{c1}(3872), \chi_{c1} \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	$< 2.4 \times 10^{-6}$	CL=90%	DESIG=116
Г72	$\gamma X(3915) \rightarrow \omega J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%	DESIG=117
Г73	$\gamma \chi_{c1}(4140) \rightarrow \phi J/\psi$	$< 1.2 \times 10^{-6}$	CL=90%	DESIG=118
Г74	$\gamma X(4350) \rightarrow \phi J/\psi$	$< 1.3 \times 10^{-6}$	CL=90%	DESIG=119
Г75	$\gamma \eta_b(1S)$	$(5.5^{+1.1}_{-0.9}) \times 10^{-4}$	S=1.2	DESIG=102
Г76	$\gamma \eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	$< 3.7 \times 10^{-6}$	CL=90%	DESIG=124
Г77	$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	$< 4.9 \times 10^{-6}$	CL=90%	DESIG=125
Г78	$\gamma X \rightarrow \gamma + \geq 4$ prongs	[a] $< 1.95 \times 10^{-4}$	CL=95%	DESIG=103
Г79	$\gamma A^0 \rightarrow \gamma$ hadrons	$< 8 \times 10^{-5}$	CL=90%	DESIG=108
Г80	$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	$< 8.3 \times 10^{-6}$	CL=90%	DESIG=123

Lepton Family number (LF) violating modes

Γ_{81}	$e^\pm \tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%
Γ_{82}	$\mu^\pm \tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%

[a] 1.5 GeV < m_X < 5.0 GeV

NODE=M052;CLUMP=B

DESIG=107

DESIG=104

LINKAGE=C52

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 13 measurements and one constraint to determine 3 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 $\langle \delta x_i \delta x_j \rangle / (\delta x_i \cdot \delta x_j)$, 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.

$$x_7 \quad \left| \quad \frac{2}{x_1} \right.$$

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

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 ± 1.5 ± 1.0	KOBEL	92	CBAL $e^+ e^- \rightarrow \mu^+ \mu^-$

NODE=M052G1
NODE=M052G1 **$\Gamma(\tau(1S) \pi^+ \pi^-) \times \Gamma(e^+ e^-) / \Gamma_{\text{total}}$** **$\Gamma_1 \Gamma_5 / \Gamma$**

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
105.4 ± 1.0 ± 4.2	11.8k	¹ AUBERT	08BP BABR	10.58 $e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

NODE=M052G03
NODE=M052G03

¹ Using $B(\tau(1S) \rightarrow e^+ e^-) = (2.38 \pm 0.11)\%$ and $B(\tau(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

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 $e^+ e^- \rightarrow \text{hadrons}$

NODE=M052G2
NODE=M052G2

¹ Radiative corrections evaluated following KURAEV 85.

² Radiative corrections reevaluated by BUCHMUELLER 88 following KURAEV 85.

NODE=M052G2;LINKAGE=P
NODE=M052G2;LINKAGE=R **$\tau(2S)$ PARTIAL WIDTHS**

NODE=M052220

 $\Gamma(e^+ e^-)$ **Γ_5**

VALUE (keV)	DOCUMENT ID
0.612 ± 0.011 OUR EVALUATION	

NODE=M052W2
NODE=M052W2

→ UNCHECKED ←

 $\tau(2S)$ BRANCHING RATIOS

NODE=M052225

 $\Gamma(\tau(1S) \pi^+ \pi^-) / \Gamma_{\text{total}}$ **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	$\tau(2S) \rightarrow \pi^+ \pi^- \mu^+ \mu^-$
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 $\pi^+ \pi^- \ell^+ \ell^-, \pi^+ \pi^- \text{MM}$

NODE=M052R4
NODE=M052R4
NODE=M052R4

18.1 ±0.5 ±1.0	11.6k	ALBRECHT	87	ARG	$e^+e^- \rightarrow \pi^+\pi^-$ MM
16.9 ±4.0		GELPHMAN	85	CBAL	$e^+e^- \rightarrow e^+e^-\pi^+\pi^-$
19.1 ±1.2 ±0.6		BESSON	84	CLEO	$\pi^+\pi^-$ 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;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=M052R5

NODE=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.

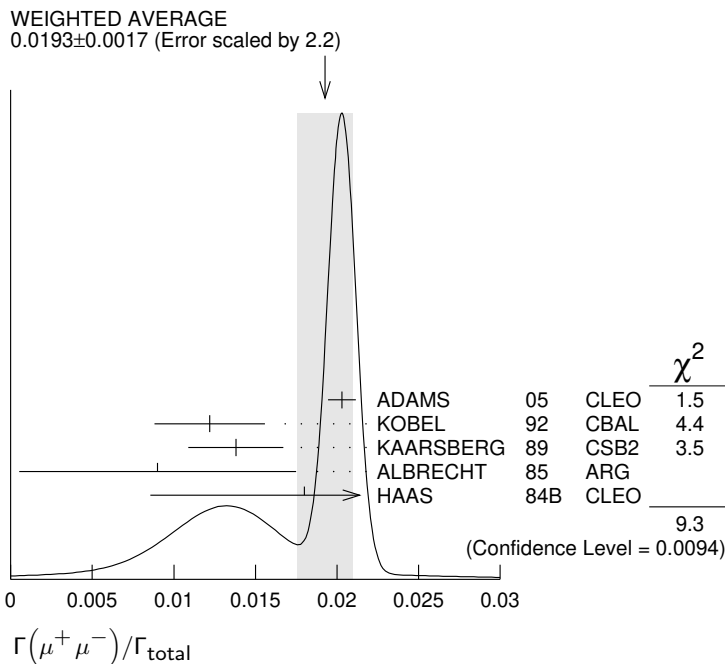
² Re-evaluated using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 0.026$.

NODE=M052R1

NODE=M052R1

NODE=M052R1;LINKAGE=A

NODE=M052R1;LINKAGE=R



$\Gamma(\tau^+\tau^-)/\Gamma(\mu^+\mu^-)$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_4
1.04±0.04±0.05	22k	BESSION	07	CLEO $e^+e^- \rightarrow \Upsilon(2S)$	

NODE=M052R17
NODE=M052R17

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma_{\text{total}}$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ

NODE=M052R10
NODE=M052R10

• • • 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 $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = 17.85 \times 10^{-2}$.

NODE=M052R10;LINKAGE=TA

² Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

NODE=M052R10;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ_1
<2.3	90	TAMPONI	13	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$	

NODE=M052R09
NODE=M052R09

$\Gamma(\Upsilon(1S)\eta)/\Gamma_{\text{total}}$

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT	Γ_7/Γ

NODE=M052R6
NODE=M052R6

2.9 ±0.4 OUR FIT Error includes scale factor of 2.0.

2.9 ±0.4 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

2.39±0.31±0.14	112	¹ LEES	11L	BABR	$\Upsilon(2S) \rightarrow \ell^+\ell^-\eta$
2.1 ^{+0.7} _{-0.6} ±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±0.32±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	ALEXANDER	98	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	BESSION	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.

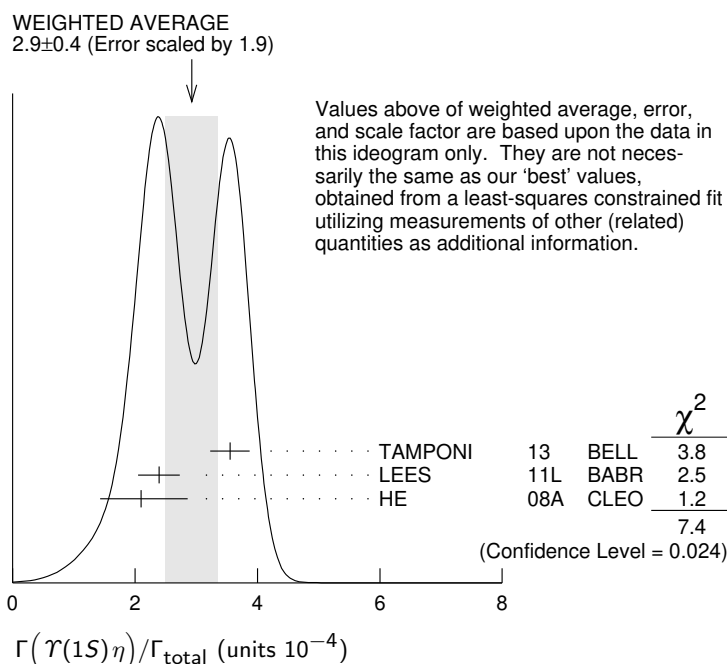
⁴ Using $\Gamma_{ee}(\Upsilon(2S)) = 0.612 \pm 0.011$ keV.

NODE=M052R6;LINKAGE=AU

NODE=M052R6;LINKAGE=HE

NODE=M052R6;LINKAGE=TA

NODE=M052R6;LINKAGE=UB



$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$

Γ_7/Γ_1

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

1.64±0.25 OUR FIT Error includes scale factor of 2.0.

1.99±0.14±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±0.17±0.08	¹ LEES	11L	BABR	$\Upsilon(2S) \rightarrow (\pi^+\pi^-)(\gamma\gamma)\mu^+\mu^-$
< 5.2	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

$\Gamma(\Upsilon(1S)\pi^0)/\Gamma(\Upsilon(1S)\eta)$

Γ_6/Γ_7

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

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

<0.13 90 TAMPONI 13 BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^0$

NODE=M052R23
NODE=M052R23

$\Gamma(J/\psi(1S) \text{ anything})/\Gamma_{\text{total}}$

Γ_8/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<0.006 90 MASCHMANN 90 CBAL $e^+e^- \rightarrow \text{hadrons}$

NODE=M052R16
NODE=M052R16

$\Gamma(J/\psi(1S)\eta_c)/\Gamma_{\text{total}}$

Γ_9/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<5.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R53
NODE=M052R53

$\Gamma(J/\psi(1S)\chi_{c0})/\Gamma_{\text{total}}$

Γ_{10}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<3.4 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R54
NODE=M052R54

$\Gamma(J/\psi(1S)\chi_{c1})/\Gamma_{\text{total}}$

Γ_{11}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<1.2 × 10⁻⁶ 90 YANG 14 BELL $e^+e^- \rightarrow J/\psi X$

NODE=M052R55
NODE=M052R55

$\Gamma(Z_c(4200)^+ Z_c(4200)^-)/\Gamma_{\text{total}}$
 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 $B(Z_c(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1$				

NODE=M052R72
NODE=M052R72

NODE=M052R72;LINKAGE=A

 $\Gamma(Z_c(3900)^\pm Z_c(4200)^\mp)/\Gamma_{\text{total}}$
 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 $B(Z_c(4200)^\pm \rightarrow J/\psi \pi^\pm) = 1 = B(Z_c(3900)^\pm \rightarrow J/\psi \pi^\pm)$.				

NODE=M052R73
NODE=M052R73

NODE=M052R73;LINKAGE=A

 $\Gamma(X(4050)^+ X(4050)^-)/\Gamma_{\text{total}}$
 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 $B(X(4050)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm)$				

NODE=M052R74
NODE=M052R74

NODE=M052R74;LINKAGE=A

 $\Gamma(X(4250)^+ X(4250)^-)/\Gamma_{\text{total}}$
 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 $B(X(4250)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm) = 1$				

NODE=M052R75
NODE=M052R75

NODE=M052R75;LINKAGE=A

 $\Gamma(X(4050)^\pm X(4250)^\mp)/\Gamma_{\text{total}}$
 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 $B(X(4050)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm) = 1 = B(X(4250)^\pm \rightarrow \chi_{c1}(1P) \pi^\pm)$				

NODE=M052R76
NODE=M052R76

NODE=M052R76;LINKAGE=A

 $\Gamma(Z_c(4430)^+ Z_c(4430)^-)/\Gamma_{\text{total}}$
 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 $B(Z_c(4430)^\pm \rightarrow \psi(2S) \pi^\pm) = 1$				

NODE=M052R77
NODE=M052R77

NODE=M052R77;LINKAGE=A

 $\Gamma(X(4055)^\pm X(4055)^\mp)/\Gamma_{\text{total}}$
 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 $B(X(4055)^\pm \rightarrow \psi(2S) \pi^\pm) = 1$				

NODE=M052R79
NODE=M052R79

NODE=M052R79;LINKAGE=A

 $\Gamma(X(4055)^\pm Z_c(4430)^\mp)/\Gamma_{\text{total}}$
 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 $B(X(4055)^\pm \rightarrow \psi(2S) \pi^\pm) = 1 = B(Z_c(4430)^\pm \rightarrow \psi(2S) \pi^\pm)$				

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
$2.78^{+0.30}_{-0.26}$				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 $e^+ e^- \rightarrow \overline{2H} X$

NODE=M052R18
NODE=M052R18

 $\Gamma(g g g)/\Gamma_{\text{total}}$
 Γ_{37}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
58.8 ± 1.2	6M	¹ BESSON	06A	CLEO $\Upsilon(2S) \rightarrow \text{hadrons}$

NODE=M052R01
NODE=M052R01

¹ Calculated using the value $\Gamma(\gamma g g)/\Gamma(g g g) = (3.18 \pm 0.04 \pm 0.22 \pm 0.41)\%$ 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 $\Gamma(\gamma g g)/\Gamma_{\text{total}}$ measurement of BESSON 06A.

NODE=M052R01;LINKAGE=BE

 $\Gamma(\gamma g g)/\Gamma(g g g)$
 Γ_{38}/Γ_{37}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$3.18 \pm 0.04 \pm 0.47$	6M	BESSON	06A	CLEO $\Upsilon(2S) \rightarrow (\gamma +) \text{hadrons}$

NODE=M052R03
NODE=M052R03

$\Gamma(\phi K^+ K^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ NODE=M052R43
NODE=M052R43

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.58 \pm 0.33 \pm 0.18$	58	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(K^+ K^-)$

 $\Gamma(\omega \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{40}/Γ NODE=M052R44
NODE=M052R44

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<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 NODE=M052R45
NODE=M052R45

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.32 \pm 0.40 \pm 0.54$	135	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(\phi f'_2(1525))/\Gamma_{\text{total}}$ Γ_{42}/Γ NODE=M052R46
NODE=M052R46

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.33	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(K^+ K^-)$

 $\Gamma(\omega f_2(1270))/\Gamma_{\text{total}}$ Γ_{43}/Γ NODE=M052R47
NODE=M052R47

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<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 NODE=M052R48
NODE=M052R48

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.88	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{45}/Γ NODE=M052R49
NODE=M052R49

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.53 \pm 0.52 \pm 0.19$	32	SHEN	12A BELL	$\Upsilon(1S) \rightarrow K^+ K^- \pi^+ \pi^-$

 $\Gamma(K_1(1270)^\pm K^\mp)/\Gamma_{\text{total}}$ Γ_{46}/Γ NODE=M052R50
NODE=M052R50

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<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 NODE=M052R51
NODE=M052R51

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<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 NODE=M052R52
NODE=M052R52

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.40	90	SHEN	12A BELL	$\Upsilon(1S) \rightarrow 2(\pi^+ \pi^-) \pi^0$

 $\Gamma(\rho\pi)/\Gamma_{\text{total}}$ Γ_{49}/Γ NODE=M052R27
NODE=M052R27

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.16	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$

 $\Gamma(\pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{50}/Γ NODE=M052R28
NODE=M052R28

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<0.80	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0$

 $\Gamma(\omega \pi^0)/\Gamma_{\text{total}}$ Γ_{51}/Γ NODE=M052R29
NODE=M052R29

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
<1.63	90	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

 $\Gamma(\pi^+ \pi^- \pi^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{52}/Γ NODE=M052R30
NODE=M052R30

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
$13.0 \pm 1.9 \pm 2.1$	261 ± 37	SHEN	13 BELL	$\Upsilon(2S) \rightarrow \pi^+ \pi^- \pi^0 \pi^0$

 $\Gamma(K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{53}/Γ NODE=M052R40
NODE=M052R40

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$1.14 \pm 0.30 \pm 0.13$	40 ± 10		SHEN	13 BELL	$\Upsilon(2S) \rightarrow K_S^0 K^- \pi^+$

• • • 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

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{54}/Γ

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

 $\Gamma(K^*(892)^- K^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{55}/Γ

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

 $\Gamma(f_1(1285) \text{ anything})/\Gamma_{\text{total}}$ Γ_{56}/Γ

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

 $\Gamma(f_1(1285) X_{\text{tetra}})/\Gamma_{\text{total}}$ Γ_{57}/Γ

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

 $\Gamma(\text{Sum of 100 exclusive modes})/\Gamma_{\text{total}}$ Γ_{58}/Γ

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

 $\Gamma(\gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$ Γ_{59}/Γ

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

 $\Gamma(\gamma \chi_{b2}(1P))/\Gamma_{\text{total}}$ Γ_{60}/Γ

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

 $\Gamma(\gamma \chi_{b0}(1P))/\Gamma_{\text{total}}$ Γ_{61}/Γ

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

 $\Gamma(\gamma f_0(1710))/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<59	90	¹ ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma K^+ K^-$

NODE=M052R13
 NODE=M052R13

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

< 5.9	90	² ALBRECHT	89	ARG $\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

OCCUR=2

¹ Re-evaluated assuming $B(f_0(1710) \rightarrow K^+ K^-) = 0.19$.

NODE=M052R13;LINKAGE=M

² Includes unknown branching ratio of $f_0(1710) \rightarrow \pi^+ \pi^-$.

NODE=M052R13;LINKAGE=N

$\Gamma(\gamma f'_2(1525))/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<53	90	¹ ALBRECHT 89	ARG	$\Upsilon(2S) \rightarrow \gamma K^+ K^-$

¹ Re-evaluated assuming $B(f'_2(1525) \rightarrow K \bar{K}) = 0.71$.

NODE=M052R12
NODE=M052R12

NODE=M052R12;LINKAGE=L

 $\Gamma(\gamma f_2(1270))/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<24.1	90	¹ ALBRECHT 89	ARG	$\Upsilon(2S) \rightarrow \gamma \pi^+ \pi^-$

¹ Using $B(f_2(1270) \rightarrow \pi \pi) = 0.84$.

NODE=M052R11
NODE=M052R11

NODE=M052R11;LINKAGE=K

 $\Gamma(\gamma f_J(2220))/\Gamma_{\text{total}}$ Γ_{65}/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_{66}/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_{67}/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_{68}/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_{69}/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_{70}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.2 $\times 10^{-5}$	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 $B(\chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi(1S)) = 3.6 \times 10^{-2}$.

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_{71}/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

 $\Gamma(\gamma X(3915) \rightarrow \omega J/\psi)/\Gamma_{\text{total}}$ Γ_{72}/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_{73}/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_{74}/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_{75}/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 $\Upsilon(2S) \rightarrow \gamma X$

NODE=M052R15
NODE=M052R15

• • • 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;LINKAGE=BO
NODE=M052R15;LINKAGE=SU

$\Gamma(\gamma\eta_b(1S) \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<3.7 × 10⁻⁶	90	SANDILYA	13	BELL $\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R25
NODE=M052R25

$\Gamma(\gamma X_{b\bar{b}} \rightarrow \gamma \text{Sum of 26 exclusive modes})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10 ⁻⁶)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
< 4.9	90		SANDILYA	13	BELL $\Upsilon(2S) \rightarrow \gamma$ hadrons

NODE=M052R26
NODE=M052R26

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

46.2 ^{+29.7} _{-14.2} ± 10.6	10	¹ DOBBS	12		$\Upsilon(2S) \rightarrow \gamma$ hadrons

¹ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

NODE=M052R26;LINKAGE=DO

$\Gamma(\gamma X \rightarrow \gamma + \geq 4 \text{ prongs})/\Gamma_{\text{total}}$ Γ_{78}/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_{79}/Γ

(0.3 GeV < m_{A^0} < 7 GeV)

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<8 × 10⁻⁵	90	¹ LEES	11H	BABR $\Upsilon(2S) \rightarrow \gamma$ 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

$\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10 ⁻⁶)	CL%	DOCUMENT ID	TECN	COMMENT
<8.3	90	¹ AUBERT	09Z	BABR $e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

¹ For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from 0.26–8.3 × 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_{81}/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_{82}/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 ± 0.02 ± 0.11	906k	LEES	11C	BABR $e^+e^- \rightarrow \pi^+ \pi^- X$

NODE=M052R05
NODE=M052R05

T(2S) REFERENCES

NODE=M052

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.)	REFID=52660
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
ASNER	07	PR D75 012009	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=51617
BESSON	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.)	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
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
ARTAMONOV	00	PL B474 427	A.S. Artamonov <i>et al.</i>		REFID=47424
EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)	REFID=46612
ALEXANDER	98	PR D58 052004	J.P. Alexander <i>et al.</i>	(CLEO Collab.)	REFID=46329
BARU	96	PRPL 267 71	S.E. Baru <i>et al.</i>	(NOVO)	REFID=44651
KOBEL	92	ZPHY C53 193	M. Kobel <i>et al.</i>	(Crystal Ball Collab.)	REFID=41861
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)	REFID=41224
ALBRECHT	89	ZPHY C42 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40731
KAARSBERG	89	PRL 62 2077	T.M. Kaarsberg <i>et al.</i>	(CUSB Collab.)	REFID=40733
BUCHMUEL...	88	HE e^+e^- Physics 412	W. Buchmueller, S. Cooper	(HANN, DESY, MIT)	REFID=40034
Editors: A. Ali and P. Soeding, World Scientific, Singapore					
JAKUBOWSKI	88	ZPHY C40 49	Z. Jakubowski <i>et al.</i>	(Crystal Ball Collab.)	REFID=40742
ALBRECHT	87	ZPHY C35 283	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=40016
COHEN	87	RMP 59 1121	E.R. Cohen, B.N. Taylor	(RISC, NBS)	REFID=11616
LURZ	87	ZPHY C36 383	B. Lurz <i>et al.</i>	(Crystal Ball Collab.)	REFID=40021
BARU	86B	ZPHY C32 622 (erratum)	S.E. Baru <i>et al.</i>	(NOVO)	REFID=22338
ALBRECHT	85	ZPHY C28 45	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22334
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)	REFID=22288
GELPHMAN	85	PR D32 2893	D. Gelphman <i>et al.</i>	(Crystal Ball Collab.)	REFID=22336
KURAEV	85	SJNP 41 466	E.A. Kuraev, V.S. Fadin	(NOVO)	REFID=40033
Translated from YAF 41 733.					
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)	REFID=22289
ARTAMONOV	84	PL 137B 272	A.S. Artamonov <i>et al.</i>	(NOVO)	REFID=22278
BARBER	84	PL 135B 498	D.P. Barber <i>et al.</i>		REFID=22327;ERROR=11
BESSON	84	PR D30 1433	D. Besson <i>et al.</i>	(CLEO Collab.)	REFID=22279
FONSECA	84	NP B242 31	V. Fonseca <i>et al.</i>	(CUSB Collab.)	REFID=22329
GILES	84B	PR D29 1285	R. Giles <i>et al.</i>	(CLEO Collab.)	REFID=22280
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22287
HAAS	84B	PR D30 1996	J. Haas <i>et al.</i>	(CLEO Collab.)	REFID=22332
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)	REFID=22285
ALBRECHT	82	PL 116B 383	H. Albrecht <i>et al.</i>	(DESY, DORT, HEIDH+)	REFID=22270
NICZYPORUK	81B	PL 100B 95	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22319
NICZYPORUK	81C	PL 99B 169	B. Niczyporuk <i>et al.</i>	(LENA Collab.)	REFID=22318
BOCK	80	ZPHY C6 125	P. Bock <i>et al.</i>	(HEIDP, MPIM, DESY, HAMB)	REFID=22264

$\Upsilon_2(1D)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

was $\Upsilon(1D)$

First observed by BONVICINI 04 in the decay to $\gamma\gamma \Upsilon(1S)$ and confirmed by DEL-AMO-SANCHEZ 10R in the decay to $\pi^+\pi^- \Upsilon(1S)$.

Data consistent with $J^P = 2^-$. The states with $J = 1$ and 3 also possibly seen, but need confirmation.

NODE=M177

NODE=M177

 $\Upsilon_2(1D)$ MASS

NODE=M177M

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	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$
10161.1±0.6±1.6	38	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$

 $\Upsilon_2(1D)$ DECAY MODES

NODE=M177215;NODE=M177

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \gamma\gamma \Upsilon(1S)$	seen
$\Gamma_2 \quad \gamma\chi_{bJ}(1P)$	seen
$\Gamma_3 \quad \eta \Upsilon(1S)$	not seen
$\Gamma_4 \quad \pi^+\pi^- \Upsilon(1S)$	$(6.6 \pm 1.6) \times 10^{-3}$

DESIG=1;OUR EVAL;→ UNCHECKED ←
 DESIG=2;OUR EVAL;→ UNCHECKED ←
 DESIG=3;OUR EVAL;→ UNCHECKED ←
 DESIG=4

 $\Upsilon_2(1D)$ BRANCHING RATIOS

NODE=M177225

$\Gamma(\eta \Upsilon(1S))/\Gamma(\gamma\gamma \Upsilon(1S))$					Γ_3/Γ_1
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.25	90	BONVICINI 04	CLE3	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$	

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}±0.06		¹ DEL-AMO-SA..10R	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\pi^+\pi^-\ell^+\ell^-$	

NODE=M177R03
 NODE=M177R03

¹ Using theoretical predictions for $B(\chi_{bJ}(2P) \rightarrow \gamma \Upsilon_2(1D))$.

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	$\Upsilon(3S) \rightarrow 4\gamma\ell^+\ell^-$	

NODE=M177R02
 NODE=M177R02

² Assuming $J = 2$.

NODE=M177R02;LINKAGE=BO

 $\Upsilon_2(1D)$ REFERENCES

NODE=M177

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.)

REFID=53634
 REFID=49759

$\chi_{b0}(2P)$

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

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

NODE=M079

$\chi_{b0}(2P)$ MASS

VALUE (MeV) DOCUMENT ID
10232.5 ± 0.4 ± 0.5 OUR EVALUATION From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M

NODE=M079M
 → UNCHECKED ←

$$m_{\chi_{b1}(2P)} = m_{\chi_{b0}(2P)}$$

VALUE (MeV) DOCUMENT ID TECN COMMENT
23.8 ± 1.7 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$

NODE=M079M2
 NODE=M079M2

γ ENERGY IN $\Upsilon(3S)$ DECAY

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 ± 0.16 ± 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 ± 0.3 ± 0.6 9903 MORRISON 91 CLE2 $e^+e^- \rightarrow \gamma X$
¹ A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
² A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M079DM

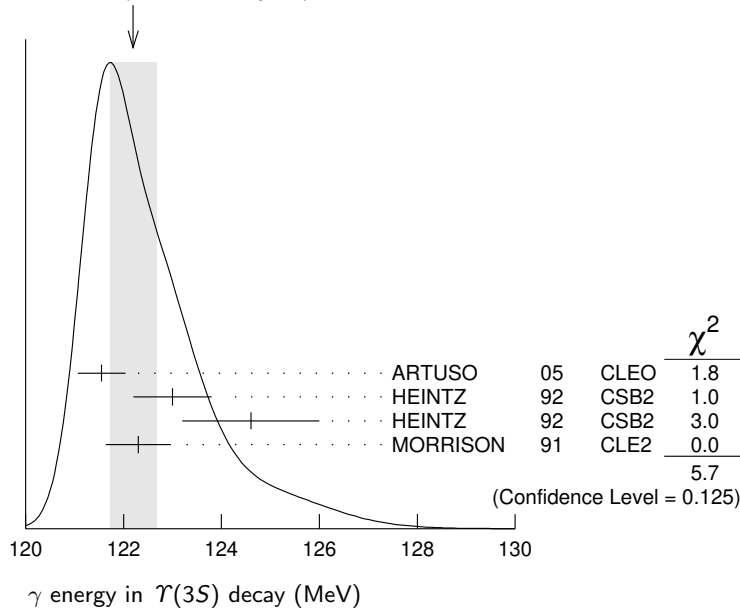
NODE=M079DM
 → UNCHECKED ←

OCCUR=2

NODE=M079DM;LINKAGE=A

NODE=M079DM;LINKAGE=B

WEIGHTED AVERAGE
 122.2 ± 0.5 (Error scaled by 1.4)



$\chi_{b0}(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
$\Gamma_1 \quad \gamma \Upsilon(2S)$	(1.38 ± 0.30) %	
$\Gamma_2 \quad \gamma \Upsilon(1S)$	(3.8 ± 1.7) × 10 ⁻³	
$\Gamma_3 \quad D^0 X$	< 8.2 %	90%
$\Gamma_4 \quad \pi^+\pi^- K^+ K^- \pi^0$	< 3.4 × 10 ⁻⁵	90%
$\Gamma_5 \quad 2\pi^+\pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
$\Gamma_6 \quad 2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 2.2 × 10 ⁻⁴	90%
$\Gamma_7 \quad 2\pi^+ 2\pi^- 2\pi^0$	< 2.4 × 10 ⁻⁴	90%
$\Gamma_8 \quad 2\pi^+ 2\pi^- K^+ K^-$	< 1.5 × 10 ⁻⁴	90%

NODE=M079215;NODE=M079

DESIG=2

DESIG=1

DESIG=3

DESIG=4

DESIG=5

DESIG=6

DESIG=7

DESIG=8

Γ_9	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times 10^{-4}$	90%	DESIG=9
Γ_{10}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times 10^{-3}$	90%	DESIG=10
Γ_{11}	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=11
Γ_{12}	$3\pi^+ 3\pi^-$	< 7	$\times 10^{-5}$	90%	DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times 10^{-3}$	90%	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=15
Γ_{16}	$4\pi^+ 4\pi^-$	< 1.7	$\times 10^{-4}$	90%	DESIG=16
Γ_{17}	$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times 10^{-4}$	90%	DESIG=17

 $\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

 $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ **Γ_1/Γ**

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R2
NODE=M079R2 **1.38 ± 0.30 OUR AVERAGE**

1.31 $\pm 0.27^{+0.13}_{-0.12}$ 3,4 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

3.6 $\pm 1.6 \pm 0.3$ 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.

⁶ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$.

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=D
NODE=M079R2;LINKAGE=E

NODE=M079R2;LINKAGE=C

NODE=M079R2;LINKAGE=LE

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 $\pm 0.17 \pm 0.03$ 8,9,10 LEES 14M BABR $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

0.9 $\pm 0.7 \pm 0.1$ 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.

⁹ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

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.

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.

¹² LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$.

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=D

NODE=M079R1;LINKAGE=E
NODE=M079R1;LINKAGE=F

NODE=M079R1;LINKAGE=C

NODE=M079R1;LINKAGE=LE

NODE=M079R1;LINKAGE=B

 $\Gamma(D^0 X)/\Gamma_{\text{total}}$ **Γ_3/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

NODE=M079R01
NODE=M079R01

$< 8.2 \times 10^{-2}$ 90 14,15 BRIERE 08 CLEO $\Upsilon(3S) \rightarrow \gamma D^0 X$

¹⁴ For $p_{D^0} > 2.5$ GeV/c.

¹⁵ The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$.

NODE=M079R01;LINKAGE=BR
NODE=M079R01;LINKAGE=RI

$$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.34	90	16 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$
16 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R02
NODE=M079R02

NODE=M079R02;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}} \quad \Gamma_5/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	17 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
17 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R03
NODE=M079R03

NODE=M079R03;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.2	90	18 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
18 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R04
NODE=M079R04

NODE=M079R04;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.4	90	19 ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$
19 ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.				

NODE=M079R05
NODE=M079R05

NODE=M079R05;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

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

$$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

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

$$\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

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

$$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

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

$$\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

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

 $\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$ Γ_{17}/Γ

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 $[\Gamma(\chi_{b0}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))]$ $< 38 \times 10^{-6}$ 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$\pm$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=M079A02NODE=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$\pm$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 AVERAGE6.6^{+4.9+2.0}_{-4.0-0.3}

35 LEES

14M BABR

 $\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$

4.0 ± 1.7 ± 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 $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$.
$$[B(\chi_{b0}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P))]$$

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=M079A03
NODE=M079A03NODE=M079A03;LINKAGE=A
NODE=M079A03;LINKAGE=BNODE=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

NODE=M080

 $\chi_{b1}(2P)$

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

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

 $\chi_{b1}(2P)$ 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

 $e^+ e^- \rightarrow \gamma X, \ell^+ \ell^- \gamma \gamma$ ¹ From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.

NODE=M080M2

NODE=M080M2

NODE=M080M2;LINKAGE=A

 γ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)

EPTS

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

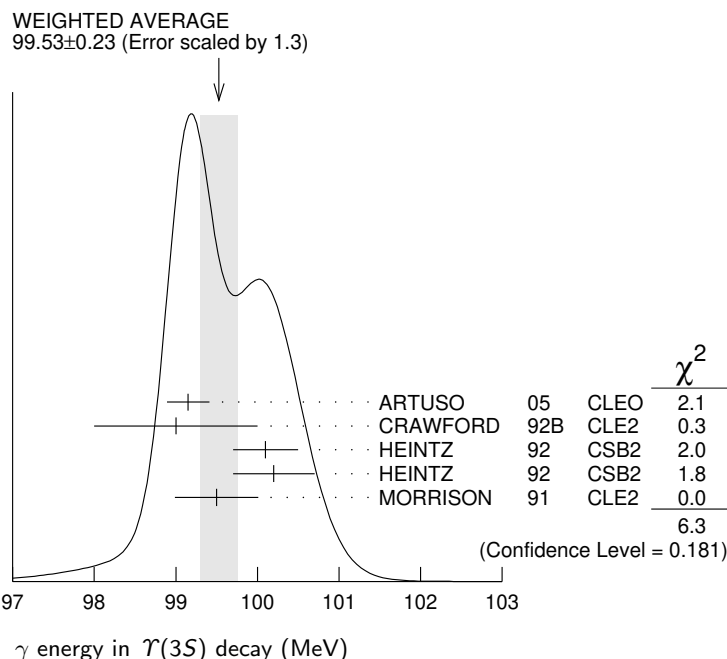
NODE=M080DM
→ UNCHECKED ←

OCCUR=2

- ²A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.
- ³A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M080DM;LINKAGE=A

NODE=M080DM;LINKAGE=B

 **$\chi_{b1}(2P)$ DECAY MODES**

NODE=M080215;NODE=M080

Mode	Fraction (Γ_i/Γ)	
Γ_1 $\omega \chi(1S)$	$(1.63^{+0.40}_{-0.34})\%$	DESIG=3
Γ_2 $\gamma \chi(2S)$	$(18.1 \pm 1.9)\%$	DESIG=2
Γ_3 $\gamma \chi(1S)$	$(9.9 \pm 1.0)\%$	DESIG=1
Γ_4 $\pi\pi\chi_{b1}(1P)$	$(9.1 \pm 1.3) \times 10^{-3}$	DESIG=4
Γ_5 $D^0 X$	$(8.8 \pm 1.7)\%$	DESIG=5
Γ_6 $\pi^+\pi^-K^+K^-\pi^0$	$(3.1 \pm 1.0) \times 10^{-4}$	DESIG=6
Γ_7 $2\pi^+\pi^-K^-K_S^0$	$(1.1 \pm 0.5) \times 10^{-4}$	DESIG=7
Γ_8 $2\pi^+\pi^-K^-K_S^0 2\pi^0$	$(7.7 \pm 3.2) \times 10^{-4}$	DESIG=8
Γ_9 $2\pi^+ 2\pi^- 2\pi^0$	$(5.9 \pm 2.0) \times 10^{-4}$	DESIG=9
Γ_{10} $2\pi^+ 2\pi^- K^+K^-$	$(10 \pm 4) \times 10^{-5}$	DESIG=10
Γ_{11} $2\pi^+ 2\pi^- K^+K^-\pi^0$	$(5.5 \pm 1.8) \times 10^{-4}$	DESIG=11
Γ_{12} $2\pi^+ 2\pi^- K^+K^- 2\pi^0$	$(10 \pm 4) \times 10^{-4}$	DESIG=12
Γ_{13} $3\pi^+ 2\pi^- K^-K_S^0 \pi^0$	$(6.7 \pm 2.6) \times 10^{-4}$	DESIG=13
Γ_{14} $3\pi^+ 3\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$	DESIG=14
Γ_{15} $3\pi^+ 3\pi^- 2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$	DESIG=15
Γ_{16} $3\pi^+ 3\pi^- K^+K^-$	$(2.0 \pm 0.8) \times 10^{-4}$	DESIG=16
Γ_{17} $3\pi^+ 3\pi^- K^+K^-\pi^0$	$(6.1 \pm 2.2) \times 10^{-4}$	DESIG=17
Γ_{18} $4\pi^+ 4\pi^-$	$(1.7 \pm 0.6) \times 10^{-4}$	DESIG=18
Γ_{19} $4\pi^+ 4\pi^- 2\pi^0$	$(1.9 \pm 0.7) \times 10^{-3}$	DESIG=19

 $\chi_{b1}(2P)$ BRANCHING RATIOS

NODE=M080220

$\Gamma(\omega \chi(1S))/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
$1.63^{+0.35+0.16}_{-0.31-0.15}$	$32.6^{+6.9}_{-6.1}$	⁴ CRONIN-HEN..04	CLE3	$\chi(3S) \rightarrow \gamma \omega \chi(1S)$	

NODE=M080R3
NODE=M080R3

⁴Using $B(\chi(3S) \rightarrow \gamma \chi_{b1}(2P)) = (11.3 \pm 0.6)\%$ and $B(\chi(1S) \rightarrow \ell^+ \ell^-) = 2$
 $B(\chi(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$.

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±0.017±0.019	5,6,7	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
0.190±0.018±0.017	4.3k	8 LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$
0.206±0.035±0.019	5,9	CRAWFORD	92B CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
0.132±0.018±0.012	5,10	HEINTZ	92 CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

⁵ Assuming $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.

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.

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.

⁹ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \ell^+\ell^-) = (10.23 \pm 1.20 \pm 1.26) 10^{-4}$.

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
NODE=M080R2

NODE=M080R2;LINKAGE=D
NODE=M080R2;LINKAGE=E

NODE=M080R2;LINKAGE=F

NODE=M080R2;LINKAGE=LE

NODE=M080R2;LINKAGE=B

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	14 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	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

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.

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.

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.

¹⁵ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2 B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (6.47 \pm 1.12 \pm 0.82) 10^{-4}$.

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
NODE=M080R1

NODE=M080R1;LINKAGE=D
NODE=M080R1;LINKAGE=E

NODE=M080R1;LINKAGE=G

NODE=M080R1;LINKAGE=LE

NODE=M080R1;LINKAGE=B

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	$\Upsilon(3S) \rightarrow 2(\gamma\pi\ell)$

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 $B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b1}(2P)\gamma) = (12.6 \pm 1.2) \times 10^{-2}$.

¹⁸ CAWLFIELD 06 quote $\Gamma(\chi_b(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ 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
NODE=M080R4

NODE=M080R4;LINKAGE=LE

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	$\Upsilon(3S) \rightarrow \gamma D^0 X$

¹⁹ For $p_{D^0} > 2.5$ GeV/c.

NODE=M080R01
NODE=M080R01

NODE=M080R01;LINKAGE=BR

$$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_6/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.1±1.0±0.3	30	²⁰ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$
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
NODE=M080R02

NODE=M080R02;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}} \quad \Gamma_7/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
1.1±0.5±0.1	10	²¹ ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$
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
NODE=M080R03

NODE=M080R03;LINKAGE=AS

$$\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_8/\Gamma$$

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
7.7±3.1±0.7	15	²² ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$
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
NODE=M080R04

NODE=M080R04;LINKAGE=AS

$$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_9/\Gamma$$

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

$$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}} \quad \Gamma_{10}/\Gamma$$

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

$$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{11}/\Gamma$$

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

$$\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{12}/\Gamma$$

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

$$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{13}/\Gamma$$

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$\pm$0.4$\pm$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$\pm$4$\pm$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$\pm$0.7$\pm$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$\pm$2.1$\pm$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$\pm$0.6$\pm$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$\pm$7$\pm$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$\pm$0.3$\pm$0.6	15k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B01
 NODE=M080B01

 $B(\chi_{b1}(2P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$

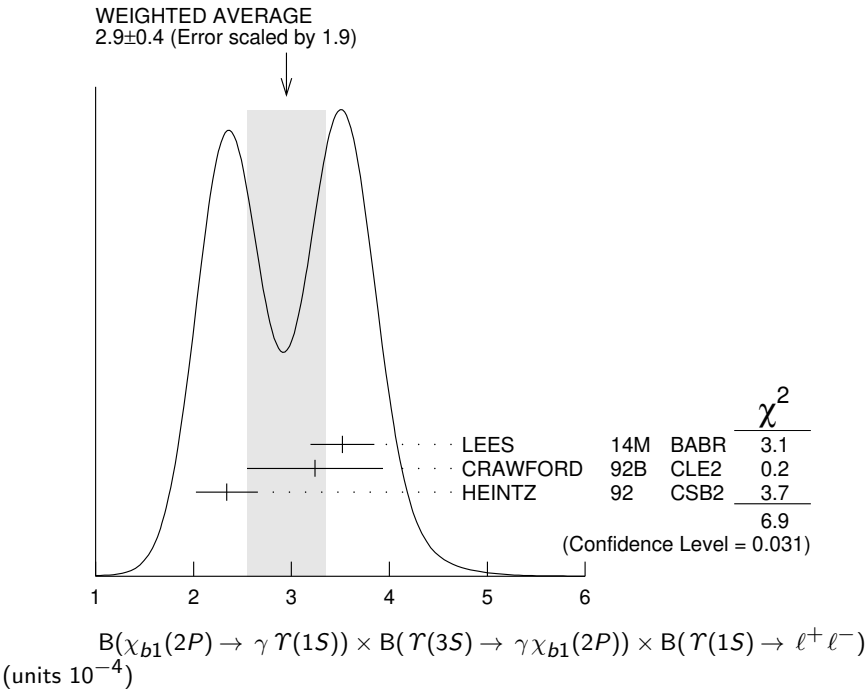
NODE=M080A00
 NODE=M080A00

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
2.9 $\pm$ 0.4 OUR AVERAGE	Error includes scale factor of 1.9. See the ideogram below.			
3.52 $^{+0.28}_{-0.27} \pm 0.17$		34 LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma \gamma \mu^+ \mu^-$
3.24 $\pm 0.56 \pm 0.41$	58	35 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.34 $\pm 0.28 \pm 0.15$		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



$\Gamma(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P))/\Gamma_{\text{total}}$
 $\Gamma_2/\Gamma \times \Gamma_{21}^{\Upsilon(3S)}/\Gamma^{\Upsilon(3S)}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 0.1 \pm 0.2$	4.3k	LEES	11J BABR	$\Upsilon(3S) \rightarrow X\gamma$

NODE=M080B02
NODE=M080B02

$B(\chi_{b1}(2P) \rightarrow \gamma\Upsilon(2S)) \times B(\Upsilon(3S) \rightarrow \gamma\chi_{b1}(2P)) \times B(\Upsilon(2S) \rightarrow \ell^+\ell^-)$

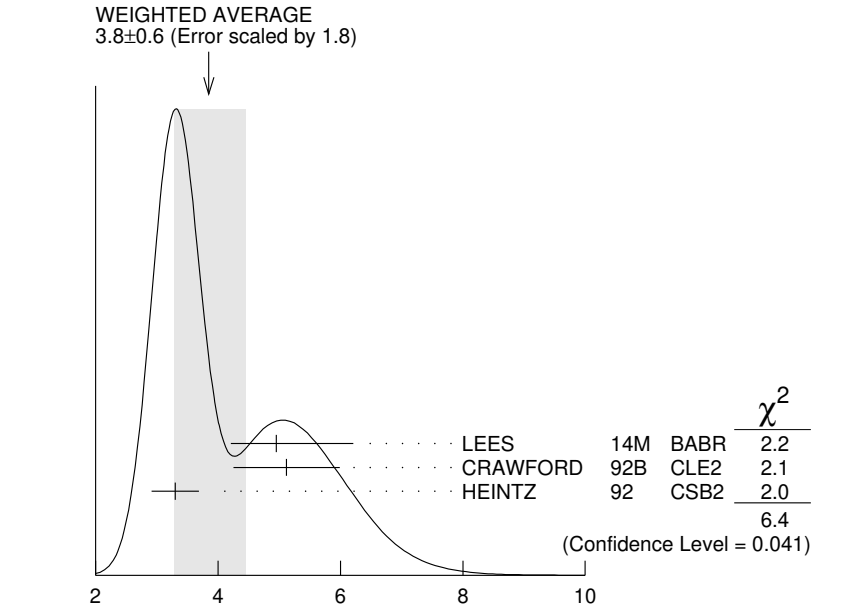
VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
3.8 ± 0.6	OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.		
$4.95^{+0.75+1.01}_{-0.70-0.24}$	37	LEES	14M BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$5.12 \pm 0.60 \pm 0.63$	111	38 CRAWFORD	92B CLE2	$\Upsilon(3S) \rightarrow \gamma\gamma\ell^+\ell^-$
$3.30 \pm 0.33 \pm 0.20$	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})

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
1.16±0.07±0.12	31k	LEES	11C BABR	$e^+ e^- \rightarrow \pi^+ \pi^- X$

NODE=M080R16
NODE=M080R16

VALUE	DOCUMENT ID	TECN	COMMENT
1.109±0.007±0.040	BRIERE 07	CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R20
NODE=M080R20

VALUE	DOCUMENT ID	TECN	COMMENT
1.082±0.025±0.060	BRIERE 07	CLEO	$\Upsilon(3S) \rightarrow \gamma \chi_{bJ}(2P)$

NODE=M080R21
NODE=M080R21

$\chi_{b1}(2P)$ REFERENCES

NODE=M080

LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=56343
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=16775
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=52577
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)	REFID=51887
CRAWFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)	REFID=50997
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50454
CRONIN-HENNESSY	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)	REFID=49766
CRAWFORD	92B	PL B294 139	G. Crawford <i>et al.</i>	(CLEO Collab.)	REFID=43177
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)	REFID=43604
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)	REFID=41586

$h_b(2P)$

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

OMITTED FROM SUMMARY TABLE

Quantum numbers are quark model predictions.

 $h_b(2P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10259.8±0.5±1.1	90k	MIZUK	12	BELL $e^+e^- \rightarrow \pi^+\pi^-$ hadrons
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10259.8±0.6 ^{+1.4} _{-1.0}	83.9k	¹ ADACHI	12	BELL 10.86 $e^+e^- \rightarrow \pi^+\pi^-$ MM
¹ Superseded by MIZUK 12.				

 $h_b(2P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	not seen
Γ_2 $\eta_b(1S)\gamma$	(22± 5) %
Γ_3 $\eta_b(2S)\gamma$	(48±13) %

 $h_b(2P)$ 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	
$\Gamma(\eta_b(1S)\gamma)/\Gamma_{\text{total}}$				Γ_2/Γ	
VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT	
22.3±3.8^{+3.1}_{-3.3}	10k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons	
$\Gamma(\eta_b(2S)\gamma)/\Gamma_{\text{total}}$				Γ_3/Γ	
VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT	
47.5±10.5^{+6.8}_{-7.7}	26k	MIZUK	12	BELL $e^+e^- \rightarrow (\gamma)\pi^+\pi^-$ hadrons	

 $h_b(2P)$ 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

NODE=M205

NODE=M205M

NODE=M205M

NODE=M205M;LINKAGE=AD

NODE=M205215;NODE=M205

DESIG=1

DESIG=2

DESIG=3

NODE=M205225

NODE=M205R01
NODE=M205R01NODE=M205R02
NODE=M205R02NODE=M205R03
NODE=M205R03

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

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

NODE=M081M

→ UNCHECKED ←

 $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

VALUE (MeV)

DOCUMENT ID

TECN

COMMENT

13.10 $\pm$ 0.24 OUR AVERAGE12.3 $\pm$ 2.6 $\pm$ 0.6¹ 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 $\pm$ 0.5² 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

NODE=M081M2;LINKAGE=B

NODE=M081M2;LINKAGE=A

 γ ENERGY IN $\Upsilon(3S)$ DECAY

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 AVERAGE86.04 $\pm$ 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

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	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

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
NODE=M081R3

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 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

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.

⁷ Assuming $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.93 \pm 0.17)\%$.

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.

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.

¹⁰ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(2S)) \times 2$
 $B(\Upsilon(2S) \rightarrow \ell^+ \ell^-) = (4.98 \pm 0.94 \pm 0.62) 10^{-4}$.

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
NODE=M081R2

NODE=M081R2;LINKAGE=D

NODE=M081R2;LINKAGE=E
NODE=M081R2;LINKAGE=F

NODE=M081R2;LINKAGE=LE

NODE=M081R2;LINKAGE=B

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 $e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

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.

¹³ Assuming $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.05)\%$.

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.

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.

¹⁶ CRAWFORD 92B quotes $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) \times B(\chi_{b2}(2P) \rightarrow \gamma \Upsilon(1S)) \times 2$
 $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (5.03 \pm 0.94 \pm 0.63) 10^{-4}$.

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
NODE=M081R1

NODE=M081R1;LINKAGE=D

NODE=M081R1;LINKAGE=E
NODE=M081R1;LINKAGE=F

NODE=M081R1;LINKAGE=LE

NODE=M081R1;LINKAGE=B

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 $B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)X) = B(\Upsilon(3S) \rightarrow \chi_{b2}(2P)\gamma) = (13.1 \pm 1.6) \times 10^{-2}$.

¹⁹ CAWLFIELD 06 quote $\Gamma(\chi_{b2}(2P) \rightarrow \pi\pi\chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$ 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=LE

NODE=M081R4;LINKAGE=CA

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

Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.4 \times 10^{-2}$	90	20,21 BRIERE	08 CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

²⁰ For $p_{D^0} > 2.5$ 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
$3.9 \pm 1.6 \pm 0.5$	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
$0.9 \pm 0.4 \pm 0.1$	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
$2.4 \pm 1.0 \pm 0.3$	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
$4.7 \pm 2.2 \pm 0.6$	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.)
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=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

$\Upsilon(3S)$

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

NODE=M048

 $\Upsilon(3S)$ MASS

NODE=M048M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10355.2±0.5	¹ ARTAMONOV 00	MD1	$e^+e^- \rightarrow \text{hadrons}$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
10355.3±0.5	^{2,3} BARU	86B REDE	$e^+e^- \rightarrow \text{hadrons}$
¹ Reanalysis of BARU 86B using new electron mass (COHEN 87).			
² Reanalysis of ARTAMONOV 84.			
³ Superseded by ARTAMONOV 00.			

NODE=M048M

NODE=M048M;LINKAGE=AR
 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	COMMENT
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 $\Upsilon(2S)\text{anything}$	(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} $\gamma g g$	(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} $\gamma A^0 \rightarrow \gamma \text{hadrons}$	< 8 × 10 ⁻⁵	CL=90%
Γ_{29} $\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	[a] < 2.2 × 10 ⁻⁴	CL=95%
Γ_{30} $\gamma a_1^0 \rightarrow \gamma \mu^+\mu^-$	< 5.5 × 10 ⁻⁶	CL=90%
Γ_{31} $\gamma a_1^0 \rightarrow \gamma \tau^+\tau^-$	[b] < 1.6 × 10 ⁻⁴	CL=90%

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}	$\mu^{\pm}\tau^{\mp}$	LF	< 3.1	$\times 10^{-6}$	CL=90%

NODE=M048;CLUMP=C

DESIG=111

DESIG=105

[a] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$

LINKAGE=C48

[b] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.

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	⁴ GILES	84B	CLEO $e^+ e^- \rightarrow \text{hadrons}$

NODE=M048G2

NODE=M048G2

⁴ 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	⁵ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- \ell^+ \ell^-$

NODE=M048G01

NODE=M048G01

⁵ 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	^{6,7,8} BUTLER	94B CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- X$
0.111 ± 0.012	4891	^{7,8,9} BROCK	91 CLEO	$e^+ e^- \rightarrow \pi^+ \pi^- X,$ $\pi^+ \pi^- \ell^+ \ell^-$

NODE=M048R8

NODE=M048R8

⁶ 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

⁷ Using $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.48 \pm 0.06)\%$. With the assumption of $e\mu$ universality.

NODE=M048R;LINKAGE=B

⁸ Using $B(\Upsilon(2S) \rightarrow \Upsilon(1S)\pi^+\pi^-) = (18.5 \pm 0.8)\%$.

NODE=M048R;LINKAGE=D

⁹ 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	¹⁰ AUBERT	08BP BABR	$e^+ e^- \rightarrow \gamma \pi^+ \pi^- e^+ e^-$
3.12 ± 0.49	980	^{11,12} BUTLER	94B CLE2	$e^+ e^- \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
2.13 ± 0.38	974	¹³ 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	¹³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$
3.1 ± 2.0	5	MAGERAS	82 CUSB	$\Upsilon(3S) \rightarrow \pi^+ \pi^- \ell^+ \ell^-$

¹⁰ 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

¹¹ From the exclusive mode.

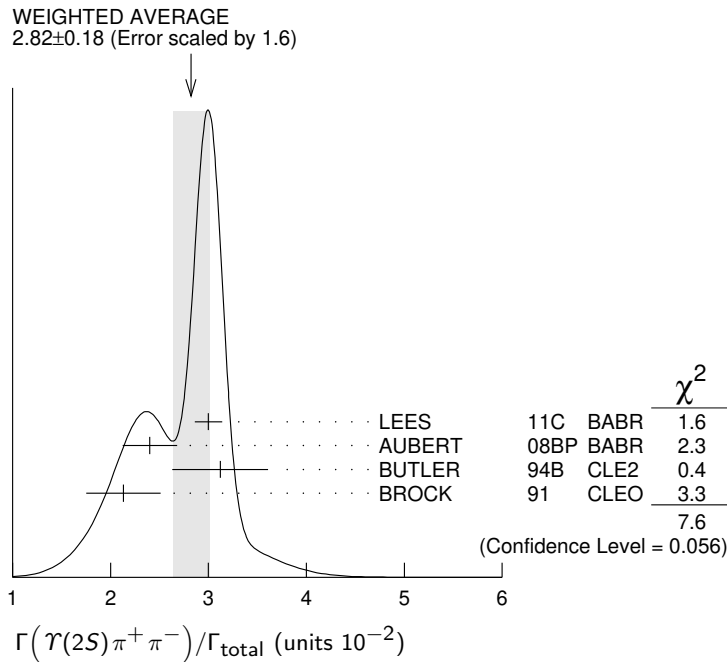
NODE=M048R;LINKAGE=M

¹² 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

¹³ 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



$\Gamma(\Upsilon(2S)\pi^0\pi^0)/\Gamma_{\text{total}}$ 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	¹⁴ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
2.16±0.39		^{15,16} BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
1.7 ±0.5 ±0.2	10	¹⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$
¹⁴ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.				
¹⁵ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.31 \pm 0.21)\%$ and assuming $e\mu$ universality.				
¹⁶ From the exclusive mode.				
¹⁷ $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$ 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

$\Gamma(\Upsilon(2S)\gamma\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.0502±0.0069	¹⁸ BUTLER	94B CLE2	$e^+e^- \rightarrow \ell^+\ell^-2\gamma$

¹⁸ From the exclusive mode.

NODE=M048R12
NODE=M048R12

NODE=M048R12;LINKAGE=M

$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10 ⁻³)	CL%	DOCUMENT ID	TECN	COMMENT
<0.51	90	¹⁹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

¹⁹ Authors assume $B(\Upsilon(2S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.06\%$.

NODE=M048R25
NODE=M048R25

NODE=M048R25;LINKAGE=HE

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ 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	²⁰ LEES	11L BABR	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.01±0.13	190k	²¹ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^+\pi^- \text{MM}$
4.17±0.06±0.19	6.4k	²² AUBERT	08BP BABR	$10.58 e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$
4.52±0.35	11830	²³ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^-X,$ $\pi^+\pi^-\ell^+\ell^-$
4.46±0.34±0.50	451	²³ WU	93 CUSB	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$
4.46±0.30	11221	²³ 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	$\Upsilon(3S) \rightarrow \pi^+\pi^-\ell^+\ell^-$

²⁰ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$ and $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

²¹ A weighted average of the inclusive and exclusive results.

²² 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.

²³ 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	²⁴ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\ell^+\ell^-$

²⁴ 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	²⁵ BHARI	09 CLEO	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

1.99 ± 0.34	56	²⁶ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

2.2 ± 0.4 ± 0.3	33	²⁷ HEINTZ	92 CSB2	$e^+e^- \rightarrow \pi^0\pi^0\ell^+\ell^-$

²⁵ Authors assume $B(\Upsilon(1S) \rightarrow e^+e^-) + B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = 4.96\%$.

²⁶ Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.06)\%$ and assuming $e\mu$ universality.

²⁷ 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	²⁸ BHARI	09 CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

²⁸ 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	²⁹ 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	^{29,30} AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-\pi^0\ell^+\ell^-$

<0.18	90	³¹ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

<2.2	90	BROCK	91 CLEO	$e^+e^- \rightarrow \ell^+\ell^-\eta$

²⁹ Using $B(\Upsilon(1S) \rightarrow e^+e^-) = (2.38 \pm 0.11)\%$, $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

³⁰ Using $\Gamma_{ee}(\Upsilon(3S)) = 0.443 \pm 0.008$ keV.

³¹ 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	³² 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	³³ AUBERT	08BP BABR	$e^+e^- \rightarrow \gamma\pi^+\pi^-(\pi^0)\ell^+\ell^-$

³² Not independent of other values reported by LEES 11L.

³³ 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	³⁴ HE	08A CLEO	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

³⁴ 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	³⁵ GE	11 CLEO	$\Upsilon(3S) \rightarrow \pi^0$ anything

³⁵ 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	³⁶ LEES	11C BABR	$e^+e^- \rightarrow \pi^+\pi^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<18		³⁶ BUTLER	94B CLE2	$e^+e^- \rightarrow \pi^+\pi^- X$
<15		³⁶ BROCK	91 CLEO	$e^+e^- \rightarrow \pi^+\pi^- X$
³⁶ 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±0.21±0.22	15k	³⁷ BESSON 07	CLEO	$e^+e^- \rightarrow \Upsilon(3S) \rightarrow \tau^+\tau^-$
³⁷ 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
1.05±0.08±0.05	15k	BESSON 07	CLEO	$e^+e^- \rightarrow \Upsilon(3S)$

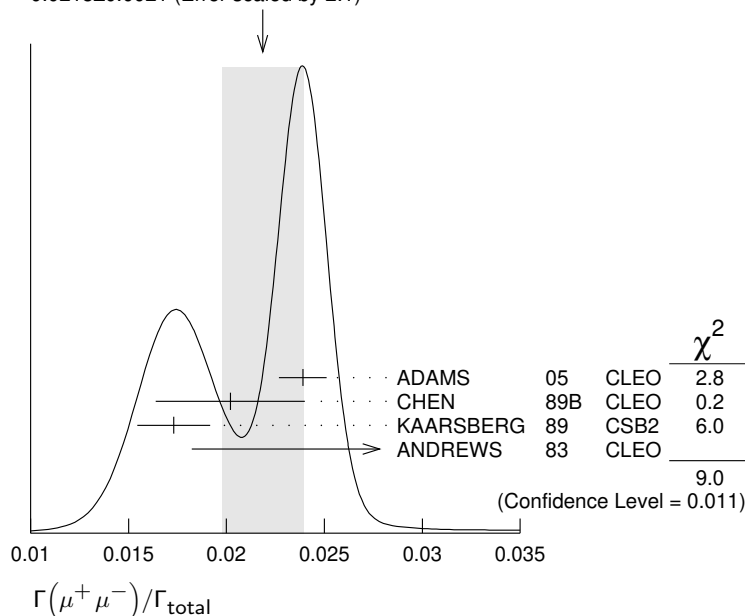
NODE=M048R19
NODE=M048R19

 $\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ 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±0.0007±0.0010	81k	ADAMS	05 CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0202±0.0019±0.0033		CHEN	89B CLEO	$e^+e^- \rightarrow \mu^+\mu^-$
0.0173±0.0015±0.0011		KAARSBERG	89 CSB2	$e^+e^- \rightarrow \mu^+\mu^-$
0.033 ±0.013 ±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	³⁸ BESSON 06A	CLEO	$\Upsilon(3S) \rightarrow \text{hadrons}$

NODE=M048R30
NODE=M048R30

NODE=M048R30;LINKAGE=BE

³⁸ 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 $B(\Upsilon(2S) \rightarrow \text{anything}) = (10.6 \pm 0.8)\%$, $B(\pi^+\pi^-\Upsilon(1S)) = (4.40 \pm 0.10)\%$, $B(\pi^0\pi^0\Upsilon(1S)) = (2.20 \pm 0.13)\%$, $B(\gamma\chi_{b2}(2P)) = (13.1 \pm 1.6)\%$, $B(\gamma\chi_{b1}(2P)) = (12.6 \pm 1.2)\%$, $B(\gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$, $B(\gamma\chi_{b0}(1P)) = (0.30 \pm 0.11)\%$, $B(\mu^+\mu^-) = (2.18 \pm 0.21)\%$, 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	³⁹ BESSON	06A CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

³⁹ 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
$2.72 \pm 0.06 \pm 0.49$	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
$2.33 \pm 0.15^{+0.31}_{-0.28}$	LEES	14G BABR	$e^+e^- \rightarrow \overline{2H} X$

 Γ_{19}/Γ

NODE=M048R00
NODE=M048R00

 $\Gamma(\gamma \chi_{b2}(2P))/\Gamma_{\text{total}}$

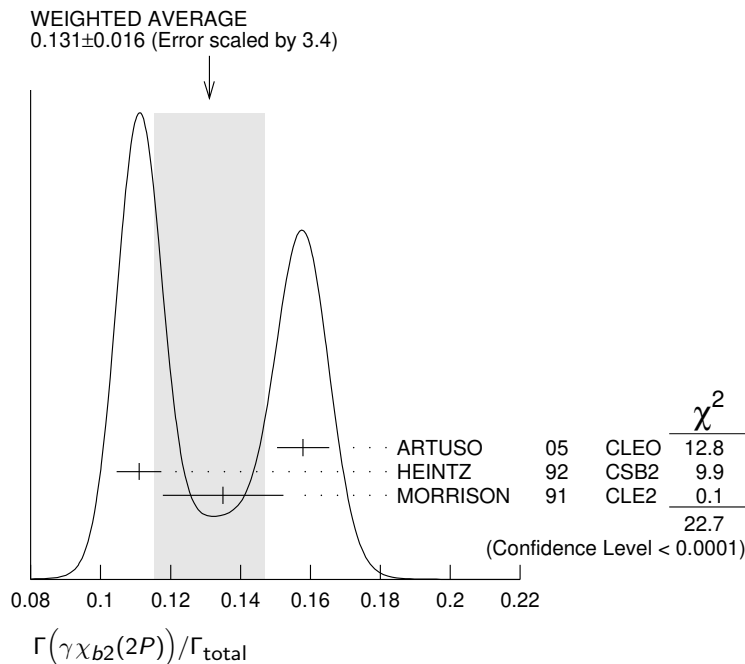
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.131 ± 0.016 OUR AVERAGE		Error includes scale factor of 3.4. See the ideogram below.		
$0.1579 \pm 0.0017 \pm 0.0073$	568k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
$0.111 \pm 0.005 \pm 0.004$	10319	⁴⁰ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
$0.135 \pm 0.003 \pm 0.017$	30741	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

 Γ_{20}/Γ

NODE=M048R5
NODE=M048R5

⁴⁰ Supersedes NARAIN 91.

NODE=M048R;LINKAGE=H

 $\Gamma(\gamma \chi_{b1}(2P))/\Gamma_{\text{total}}$

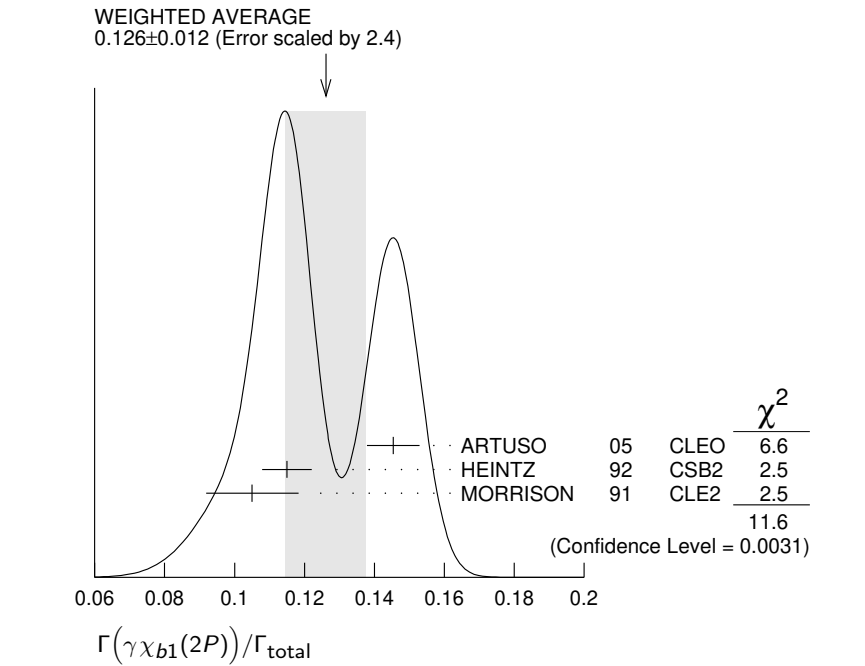
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.126 ± 0.012 OUR AVERAGE		Error includes scale factor of 2.4. See the ideogram below.		
$0.1454 \pm 0.0018 \pm 0.0073$	537k	ARTUSO	05 CLEO	$e^+e^- \rightarrow \gamma X$
$0.115 \pm 0.005 \pm 0.005$	11147	⁴¹ HEINTZ	92 CSB2	$e^+e^- \rightarrow \gamma X$
$0.105^{+0.003}_{-0.002} \pm 0.013$	25759	MORRISON	91 CLE2	$e^+e^- \rightarrow \gamma X$

 Γ_{21}/Γ

NODE=M048R6
NODE=M048R6

⁴¹ Supersedes NARAIN 91.

NODE=M048R6;LINKAGE=H

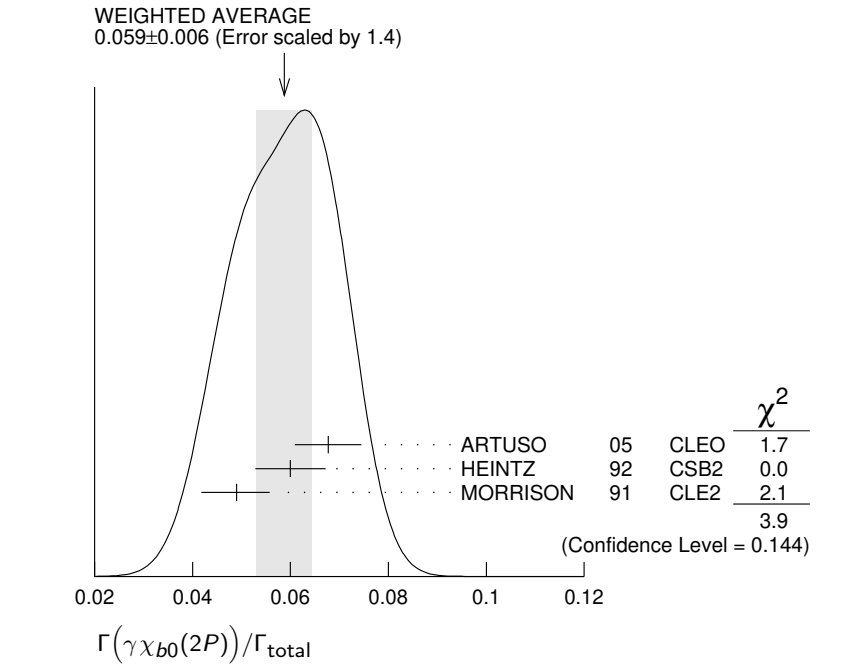


$\Gamma(\gamma\chi_{b0}(2P))/\Gamma_{\text{total}}$					Γ_{22}/Γ	
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
0.059 ± 0.006 OUR AVERAGE					Error includes scale factor of 1.4. See the ideogram below.	
0.0677 ± 0.0020 ± 0.0065	225k	ARTUSO	05	CLEO	$e^+e^- \rightarrow \gamma X$	
0.060 ± 0.004 ± 0.006	4959	42 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma X$	
0.049 ^{+0.003} _{-0.004} ± 0.006	9903	MORRISON	91	CLE2	$e^+e^- \rightarrow \gamma X$	

⁴²Supersedes 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	43,44 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	90	45 ASNER	08A	CLEO	$\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$	
seen		46 HEINTZ	92	CSB2	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$	

NODE=M048R21
NODE=M048R21

⁴³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁴ 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.

⁴⁵ 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 $B(\Upsilon(2S) \rightarrow \gamma \chi_{b2}(1P)) = 7.15 \times 10^{-2}$.

⁴⁶ 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	47,48	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 90 ⁴⁹ ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$
 seen ⁵⁰ HEINTZ 92 CSB2 $e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

⁴⁷ Assuming $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$.

⁴⁸ 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.

⁴⁹ 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 $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = 6.9 \times 10^{-2}$.

⁵⁰ 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 ⁵¹ ASNER 08A CLEO $\Upsilon(3S) \rightarrow \gamma + \text{hadrons}$

⁵¹ 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					
$7.1 \pm 1.8 \pm 1.3$	$2.3 \pm 0.5k$		⁵² BONVICINI	10 CLEO	$\Upsilon(3S) \rightarrow \gamma X$
$4.8 \pm 0.5 \pm 0.6$	$19 \pm 3k$		⁵² 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	$\Upsilon(3S) \rightarrow X \gamma$
$4.8 \pm 0.5 \pm 1.2$	$19 \pm 3k$		^{52,53} AUBERT	08V BABR	$\Upsilon(3S) \rightarrow \gamma X$
<4.3	90		⁵⁴ ARTUSO	05 CLEO	$e^+ e^- \rightarrow \gamma X$

NODE=M048R17
 NODE=M048R17

⁵² Assuming $\Gamma_{\eta_b(1S)} = 10 \text{ MeV}$.

⁵³ Systematic error re-evaluated by AUBERT 09AQ.

⁵⁴ 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	⁵⁵ LEES	11H BABR	$\Upsilon(3S) \rightarrow \gamma \text{hadrons}$

⁵⁵ 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 $\Gamma(\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.5	90	⁵⁶ AUBERT	09Z BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$

⁵⁶ For a narrow scalar or pseudoscalar a_1^0 with mass in the range 212–9300 MeV, excluding J/ψ and $\psi(2S)$. Measured 90% CL limits as a function of $m_{a_1^0}$ range from 0.27–5.5 $\times 10^{-6}$.

NODE=M048R04
NODE=M048R04

NODE=M048R04;LINKAGE=AU

 $\Gamma(\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.6 \times 10^{-4}$	90	⁵⁷ AUBERT	09P BABR	$e^+e^- \rightarrow \gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$

⁵⁷ For a narrow scalar or pseudoscalar a_1^0 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 – 16×10^{-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 $\Gamma(\mu^\pm \tau^\mp)/\Gamma_{\text{total}}$ Γ_{33}/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

LEES	14G	PR D89 111102	J.P. Lees <i>et al.</i>	(BABAR Collab.)
GE	11	PR D84 032008	J.Y. Ge <i>et al.</i>	(CLEO Collab.)
KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11C	PR D84 011104	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11H	PRL 107 221803	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11K	PR D84 091101	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11L	PR D84 092003	J.P. Lees <i>et al.</i>	(BABAR Collab.)
BONVICINI	10	PR D81 031104	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
LEES	10B	PRL 104 151802	J.P. Lees <i>et al.</i>	(BABAR 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.)
BHARI	09	PR D79 011103	S.R. Bhari <i>et al.</i>	(CLEO Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	08BP	PR D78 112002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08V	PRL 101 071801	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.)
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>	

REFID=55939
REFID=53960
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REFID=51620
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REFID=50452
REFID=50454
REFID=47424

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.)
BUCHMUEL...	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 (erratum)	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+)

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REFID=22359

NODE=M206

$\chi_{b1}(3P)$

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

Needs confirmation.

NODE=M206

Observed in the radiative decay to $\Upsilon(1S, 2S, 3S)$, therefore $C = +$.
 J needs confirmation.

$\chi_{b1}(3P)$ MASS

NODE=M206M

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
10513.42 ± 0.41 ± 0.53		¹ SIRUNYAN	18N CMS	$pp \rightarrow \gamma \mu^+ \mu^- X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
10515.7 $\pm 2.2 \pm 1.5$ $- 3.9 - 2.1$	169	² AAIJ	14BG LHCb	$pp \rightarrow \gamma \mu^+ \mu^- X$
10512.1 $\pm 2.1 \pm 0.9$	351	³ AAIJ	14BG LHCb	$pp \rightarrow \gamma \mu^+ \mu^- X$
10511.3 $\pm 1.7 \pm 2.5$	182	⁴ AAIJ	14BI LHCb	$pp \rightarrow \gamma \mu^+ \mu^- X$
10530 $\pm 5 \pm 9$		⁵ AAD	12A ATLAS	$pp \rightarrow \gamma \mu^+ \mu^- X$
10551 $\pm 14 \pm 17$		⁵ ABAZOV	12Q D0	$p\bar{p} \rightarrow \gamma \mu^+ \mu^- X$

NODE=M206M

OCCUR=2

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	$pp \rightarrow \gamma \mu^+ \mu^- X$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen		AAD	12A ATLAS	$pp \rightarrow \gamma \mu^+ \mu^- X$	
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	$pp \rightarrow \gamma\mu^+\mu^- X$
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

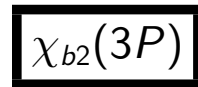
$\chi_{b1}(3P)$ REFERENCES

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

NODE=M238



$$J^{PC} = 0^+(2^{++})$$

Needs confirmation.

NODE=M238

Observed in the radiative decay to $\Upsilon(3S)$, therefore $C = +$. J needs confirmation.

$\chi_{b2}(3P)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$10524.02 \pm 0.57 \pm 0.53$	¹ SIRUNYAN	18N CMS	$pp \rightarrow \gamma\mu^+\mu^- X$
$10530 \pm 5 \pm 9$	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)
$\Upsilon_1(3S)\gamma$	seen

NODE=M238215;NODE=M238

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

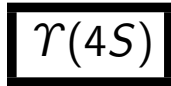
NODE=M238R01
NODE=M238R01

$\chi_{b2}(3P)$ 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



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

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^+ anything + c.c.	(17.8 ±2.6) %	
Γ_4 $B^0\bar{B}^0$	(48.6 ±0.6) %	
Γ_5 $J/\psi K_S^0 + (J/\psi, \eta_c) K_S^0$	< 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} ^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=14

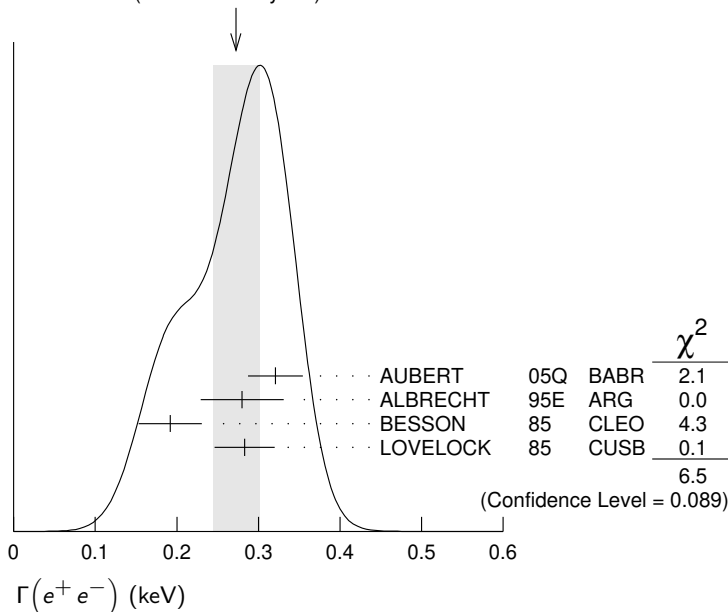
Double Radiative Decays

Γ_{25} $\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S)$	< 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±0.017±0.029	AUBERT	05Q	BABR $e^+e^- \rightarrow \text{hadrons}$
0.28 ±0.05 ±0.01	¹ ALBRECHT	95E	ARG $e^+e^- \rightarrow \text{hadrons}$
0.192±0.007±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	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±0.021±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±0.010±0.008	¹ AUBERT,B	05H	BABR $\Upsilon(4S) \rightarrow \bar{B}B \rightarrow D^*\ell\nu_\ell$
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
NODE=M047R12
→ UNCHECKED ←

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			
1.006 ± 0.036 ± 0.031	¹ AUBERT 04F	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K$
1.01 ± 0.03 ± 0.09	¹ HASTINGS 03	BELL	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow \text{dileptons}$
1.058 ± 0.084 ± 0.136	² ATHAR 02	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow D^* \ell \nu$
1.10 ± 0.06 ± 0.05	³ AUBERT 02	BABR	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow (c\bar{c}) K^*$
1.04 ± 0.07 ± 0.04	⁴ ALEXANDER 01	CLEO	$\Upsilon(4S) \rightarrow B\bar{B} \rightarrow J/\psi K^*$

¹ HASTINGS 03 and AUBERT 04F assume $\tau(B^+)/\tau(B^0) = 1.083 \pm 0.017$.² ATHAR 02 assumes $\tau(B^+)/\tau(B^0) = 1.074 \pm 0.028$. Supersedes BARISH 95.³ AUBERT 02 assumes $\tau(B^+)/\tau(B^0) = 1.062 \pm 0.029$.⁴ ALEXANDER 01 assumes $\tau(B^+)/\tau(B^0) = 1.066 \pm 0.024$.

NODE=M047R10
 NODE=M047R10
 → UNCHECKED ←

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 LEYAQUANC 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 08B0	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 intermediate 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 ± 0.2		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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. 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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. 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 $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05) \times 10^{-2}$. 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

$\Gamma(\Upsilon(1S)\eta')/\Gamma_{\text{total}}$ Γ_{20}/Γ

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

3.43 ± 0.88 ± 0.21	27	GUIDO	18 BELL	$\Upsilon(4S) \rightarrow (\rho^0\gamma, \pi^+\pi^-\eta)\mu^+\mu^-$

NODE=M047R03
NODE=M047R03

$\Gamma(\Upsilon(1S)\eta)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{19}/Γ_{18}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

2.41±0.40±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
NODE=M047R19

NODE=M047R19;LINKAGE=UB

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE (units 10 ⁻⁵)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT

8.2±0.8 OUR AVERAGE7.9±1.0±0.4 181 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \pi^+\pi^-\mu^+\mu^-$ 8.6±1.1±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±1.7±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 $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.93 \pm 0.17)\%$.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
NODE=M047R9

NODE=M047R9;LINKAGE=UB

NODE=M047R9;LINKAGE=AU

 $\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma(\Upsilon(1S)\pi^+\pi^-)$ Γ_{21}/Γ_{18}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

1.16±0.16±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
NODE=M047R20

NODE=M047R20;LINKAGE=UB

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{22}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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
NODE=M047R01

NODE=M047R01;LINKAGE=AD

 $\Gamma(h_b(1P)\eta)/\Gamma_{\text{total}}$ Γ_{23}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT

2.18±0.11±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
NODE=M047R00

NODE=M047R00;LINKAGE=A

 $\Gamma(\overline{2H} \text{ anything})/\Gamma_{\text{total}}$ Γ_{24}/Γ

VALUE (units 10 ⁻⁵)	CL%	DOCUMENT ID	TECN	COMMENT

<1.3 90 ASNER 07 CLEO $e^+e^- \rightarrow \bar{d}X$

Double Radiative Decays

NODE=M047240

 $\Gamma(\gamma\gamma\Upsilon(D) \rightarrow \gamma\gamma\eta\Upsilon(1S))/\Gamma_{\text{total}}$ Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT

<2.3 × 10⁻⁵ 90 GUIDO 17 BELL $\Upsilon(4S) \rightarrow \gamma\gamma\pi^+\pi^-\pi^0\mu^+\mu^-$ NODE=M047R24
NODE=M047R24 $\Upsilon(4S)$ REFERENCES

NODE=M047

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.)
AUBERT	04F	PR D69 071101	B.Aubert <i>et al.</i>	
HASTINGS	03	PR D67 052004	N.C. Hastings <i>et al.</i>	(BELLE Collab.)
ABE	02D	PRL 88 052001	K. Abe <i>et al.</i>	(BELLE Collab.)
ATHAR	02	PR D66 052003	S.B. Athar <i>et al.</i>	(CLEO Collab.)
AUBERT	02	PR D65 032001	B. Aubert <i>et al.</i>	(BABAR Collab.)
ALEXANDER	01	PRL 86 2737	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AUBERT	01C	PRL 87 162002	B. Aubert <i>et al.</i>	(BABAR Collab.)
GLENN	99	PR D59 052003	S. Glenn <i>et al.</i>	
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)
ALBRECHT	95E	ZPHY C65 619	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)
ALEXANDER	90C	PRL 64 2226	J. Alexander <i>et al.</i>	(CLEO Collab.)
BEBEK	87	PR D36 1289	C. Bebek <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.)
LEYAOUANC	77	PL B71 397	A. Le Yaouanc <i>et al.</i>	(ORSAY)

REFID=50777
REFID=49748
REFID=49209
REFID=48557
REFID=48832
REFID=48514
REFID=48316
REFID=48346
REFID=46890
REFID=44693
REFID=44372
REFID=44139
REFID=41346
REFID=40270
REFID=22368
REFID=22369
REFID=44695

NODE=M207

$Z_b(10610)$

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

was $X(10610)$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M207

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.

$Z_b(10610)^\pm$ MASS

NODE=M207M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
10607.2 ± 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 $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
$10611 \pm 4 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
$10609 \pm 2 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
$10608 \pm 2 \pm 3$	³ BONDAR	12	BELL $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
$10605 \pm 2^{+3}_{-1}$	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

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.

$Z_b(10610)^0$ MASS

NODE=M207M;LINKAGE=BO
NODE=M207M;LINKAGE=A
NODE=M207M;LINKAGE=BN
NODE=M207M0

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
$10609 \pm 4 \pm 4$	¹ KROKOVNY	13	BELL $e^+e^- \rightarrow \Upsilon(2S)/\Upsilon(3S)\pi^0\pi^0$

NODE=M207M0

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 $\Gamma(Z_b(10610)^0) = 18.4$ MeV.

NODE=M207M0;LINKAGE=A

$Z_b(10610)^\pm$ WIDTH

NODE=M207W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
18.4 ± 2.4	¹ BONDAR	12	BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M207W

• • • 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	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$	OCCUR=2
$18.7 \pm 3.4^{+2.5}_{-1.3}$	^{2} GARMASH	15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$	OCCUR=3
$22.3 \pm 7.7^{+3.0}_{-4.0}$	^{3} BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$	OCCUR=2
$24.2 \pm 3.1^{+2.0}_{-3.0}$	^{3} BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$	OCCUR=3
$17.6 \pm 3.0 \pm 3.0$	^{3} BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$	OCCUR=4
$11.4^{+4.5+2.1}_{-3.9-1.2}$	^{3} BONDAR	12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$	OCCUR=5
$13^{+10}_{-8}^{+9}_{-7}$	^{3} BONDAR	12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$	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

$Z_b(10610)$ 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

$Z_b(10610)$ 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 $Z_b(10610)$ 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 $Z_b(10610)$ 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

$\Gamma(\Upsilon(2S)\pi^0)/\Gamma_{\text{total}}$ Γ_4/Γ

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
NODE=M207R10

NODE=M207R10;LINKAGE=A

 $\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}}$ Γ_5/Γ

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 $Z_b(10610)$ 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
NODE=M207R03

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	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹ Assuming the $Z_b(10610)$ 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
NODE=M207R04

NODE=M207R04;LINKAGE=C

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	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

¹ Assuming the $Z_b(10610)$ 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
NODE=M207R05

NODE=M207R05;LINKAGE=C

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	$e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- B^{*+} \bar{B}^0$

¹ Assuming the $Z_b(10610)$ 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 $Z_b(10610)$ from BONDAR 12.

NODE=M207R00
NODE=M207R00

NODE=M207R00;LINKAGE=A

$$\frac{[\Gamma(B^+\bar{B}^{*0}) + \Gamma(B^{*+}\bar{B}^0)]}{[\Gamma(\Upsilon(1S)\pi^+) + \Gamma(\Upsilon(2S)\pi^+) + \Gamma(\Upsilon(3S)\pi^+) + \Gamma(h_b(1P)\pi^+) + \Gamma(h_b(2P)\pi^+)]} \Gamma_{10}/(\Gamma_1 + \Gamma_3 + \Gamma_5 + \Gamma_7 + \Gamma_9)$$

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

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

5.93 $^{+0.99+1.01}_{-0.69-0.73}$ 357 ¹ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^+ \bar{B}^{*0}, \pi^- \bar{B}^0 B^{*+}$

¹ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $Z_b(10610)$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^+ \bar{B}^{*0} + \bar{B}^0 B^{*+}$.

NODE=M207R07
NODE=M207R07

NODE=M207R07;LINKAGE=A

$Z_b(10610)$ REFERENCES

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.)
KROKOVNY	13	PR D88 052016	P. Krokovny <i>et al.</i>	(BELLE Collab.)
BONDAR	12	PRL 108 122001	A. Bondar <i>et al.</i>	(BELLE Collab.)

NODE=M207

REFID=57446
REFID=57465
REFID=56811
REFID=55588
REFID=53963

NODE=M208

$Z_b(10650)$

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

I, G, C need confirmation.

was $X(10650)^\pm$

Properties incompatible with a $q\bar{q}$ structure (exotic state). See the review on non- $q\bar{q}$ states.

NODE=M208

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.

$Z_b(10650)$ 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 $^{+1}_{-2}$	³ BONDAR	12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
10651 $^{+2}_{-3}$ $^{+3}_{-2}$	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

$Z_b(10650)$ WIDTH

VALUE (MeV) DOCUMENT ID TECN COMMENT

11.5 $\pm$ 2.2 ⁴ BONDAR 12 BELL $e^+e^- \rightarrow \text{hadrons}$

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

12.1 $^{+11.3+2.7}_{-4.8-0.6}$	⁵ GARMASH	15	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
14.2 $\pm$ 3.7 $^{+0.9}_{-0.4}$	⁵ GARMASH	15	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
9.3 $\pm$ 2.2 $^{+0.3}_{-0.5}$	⁵ GARMASH	15	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
16.3 $\pm$ 9.8 $^{+6.0}_{-2.0}$	⁶ BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
13.3 $\pm$ 3.3 $^{+4.0}_{-3.0}$	⁶ BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
8.4 $\pm$ 2.0 $\pm$ 2.0	⁶ BONDAR	12	BELL	$e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$
20.9 $^{+5.4+2.1}_{-4.7-5.7}$	⁶ BONDAR	12	BELL	$e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$
19 $\pm$ 7 $^{+11}_{-7}$	⁶ BONDAR	12	BELL	$e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

NODE=M208W

NODE=M208W

OCCUR=2

OCCUR=3

OCCUR=2

OCCUR=3

OCCUR=4

OCCUR=5

OCCUR=6

⁴ Average of the BONDAR 12 measurements in separate channels.

⁵ Correlated with the corresponding result from BONDAR 12.

⁶ Superseded by the average measurement of BONDAR 12.

NODE=M208W;LINKAGE=BO

NODE=M208W;LINKAGE=A

NODE=M208W;LINKAGE=BN

$Z_b(10650)^+$ DECAY MODES

$Z_b(10650)^-$ decay modes are charge conjugates of the modes below.

NODE=M208215;NODE=M208

NODE=M208

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 \quad \Upsilon(1S)\pi^+$	$(1.7^{+0.8}_{-0.6}) \times 10^{-3}$
$\Gamma_2 \quad \Upsilon(2S)\pi^+$	$(1.4^{+0.6}_{-0.4}) \%$
$\Gamma_3 \quad \Upsilon(3S)\pi^+$	$(1.6^{+0.7}_{-0.5}) \%$
$\Gamma_4 \quad h_b(1P)\pi^+$	$(8.4^{+2.9}_{-2.4}) \%$
$\Gamma_5 \quad h_b(2P)\pi^+$	$(15 \pm 4) \%$
$\Gamma_6 \quad B^+\bar{B}^0$	not seen
$\Gamma_7 \quad B^+\bar{B}^{*0} + B^{*+}\bar{B}^0$	not seen
$\Gamma_8 \quad B^{*+}\bar{B}^{*0}$	$(74^{+4}_{-6}) \%$

DESIG=1

DESIG=2

DESIG=3

DESIG=4

DESIG=5

DESIG=8

DESIG=6

DESIG=7

$Z_b(10650)$ BRANCHING RATIOS

NODE=M208225

$\Gamma(\Upsilon(1S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_1/\Gamma$

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

$1.7^{+0.7+0.3}_{-0.6-0.2}$ ⁷ 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 $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

⁷ Assuming the $Z_b(10650)$ 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=M208R01

NODE=M208R01

NODE=M208R01;LINKAGE=A

$\Gamma(\Upsilon(2S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_2/\Gamma$

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

$1.39^{+0.48+0.34}_{-0.38-0.23}$ ⁸ 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 $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

⁸ Assuming the $Z_b(10650)$ 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

$\Gamma(\Upsilon(3S)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_3/\Gamma$

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

$1.63^{+0.53+0.39}_{-0.42-0.28}$ ⁹ 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 $e^+e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

⁹ Assuming the $Z_b(10650)$ 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

$\Gamma(h_b(1P)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_4/\Gamma$

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

$8.41^{+2.43+1.49}_{-2.12-1.06}$ ¹⁰ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+}\bar{B}^{*0}$

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

seen ¹¹ MIZUK 16 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

seen ¹² BONDAR 12 BELL $e^+e^- \rightarrow h_b(1P)\pi^+\pi^-$

¹⁰ Assuming the $Z_b(10650)$ 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.

¹¹ Using e^+e^- energies near the $\Upsilon(11020)$.

¹² 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

 $14.7^{+3.2+2.8}_{-2.8-2.3}$ ¹³ 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

¹⁴ MIZUK 16 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$

seen

¹⁵ BONDAR 12 BELL $e^+e^- \rightarrow h_b(2P)\pi^+\pi^-$ ¹³ Assuming the $Z_b(10650)$ 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 16.¹⁴ Using e^+e^- energies near the $\Upsilon(11020)$.¹⁵ 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 ¹⁶ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$ ¹⁶ Assuming the $Z_b(10650)$ 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 $Z_b(10650)$ 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

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

 $2.80^{+0.69+0.54}_{-0.40-0.36}$ 161 ¹⁷ GARMASH 16 BELL $e^+e^- \rightarrow \pi^- B^{*+} \bar{B}^{*0}$ ¹⁷ Combined with the results of BONDAR 12 and MIZUK 16. Not independent from $Z_b(10650)$ branching fractions to $\pi^+ \Upsilon(1S, 2S, 3S)$, $\pi^+ h_b(1P, 2P)$, and $B^{*+} \bar{B}^{*0}$.NODE=M208R07
NODE=M208R07

NODE=M208R07;LINKAGE=A

 $Z_b(10650)$ 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

$\Upsilon(10753)$

$$J^{PC} = ?(1^{--})$$

OMITTED FROM SUMMARY TABLE

A candidate for $\Upsilon(3D)$ state or an exotic structure.Seen by MIZUK 19 in $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$ ($n=1,2,3$) with a significance of 5.2 σ .

NODE=M243

NODE=M243

 $\Upsilon(10753)$ 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

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

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	e^+e^-

DESIG=3

DESIG=4

DESIG=5

DESIG=2

 $\Upsilon(10753) \Gamma(i)\Gamma(e^+e^-)/\Gamma(\text{total})$

NODE=M243225

$\Gamma(\Upsilon(1S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_1\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

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

0.295 ± 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 $\Upsilon(10860)$.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

NODE=M243R00

NODE=M243R00;LINKAGE=A

NODE=M243R00;LINKAGE=B

$\Gamma(\Upsilon(2S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$				$\Gamma_2\Gamma_4/\Gamma$
VALUE (eV)	DOCUMENT ID	TECN	COMMENT	

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

0.875 ± 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 $\Upsilon(10860)$.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

NODE=M243R02

NODE=M243R02;LINKAGE=A

NODE=M243R02;LINKAGE=B

$\Gamma(\Upsilon(3S)\pi^+\pi^-) \times \Gamma(e^+e^-)/\Gamma_{\text{total}}$
 $\Gamma_3\Gamma_4/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

0.235±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 $\Upsilon(10860)$.

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
NODE=M243R03

NODE=M243R03;LINKAGE=A

NODE=M243R03;LINKAGE=B

$\Upsilon(10753)$ 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.)
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.)

NODE=M243

REFID=60595
REFID=60090
REFID=57121
REFID=52661

NODE=M092

 $\Upsilon(10860)$
 $I^G(J^{PC}) = 0^-(1^--)$

$\Upsilon(10860)$ MASS

NODE=M092M

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT

10885.2^{+2.6}_{-1.6} OUR AVERAGE

10885.3±1.5 ^{+2.2} _{-0.9}	¹ MIZUK	19	BELL $e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$

10884.7 ^{+3.6} _{-3.4} ^{+8.9} _{-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. • • •

10882 ± 1	³ DONG	20A	$e^+e^- \rightarrow b\bar{b}$

10881.8 ^{+1.0} _{-1.1} ±1.2	^{4,5} SANTEL	16	BELL $e^+e^- \rightarrow \text{hadrons}$

10891.1±3.2 ^{+1.2} _{-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} ±1.2	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 $e^+e^- \rightarrow \text{hadrons}$

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.

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

- 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 .

NODE=M092M;LINKAGE=CE

NODE=M092M;LINKAGE=UB

NODE=M092M;LINKAGE=BE

NODE=M092M;LINKAGE=LO

 $\Upsilon(10860)$ WIDTH

NODE=M092W

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
37 ± 4 OUR AVERAGE			
$36.6^{+4.5+0.5}_{-3.9-1.1}$	¹ MIZUK	19 BELL	$e^+e^- \rightarrow \Upsilon(nS)\pi^+\pi^-$
$40.6^{+12.7+1.1}_{-8.0-19.1}$	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. • • •			
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	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
46^{+9}_{-7}	^{8,9} CHEN	10 BELL	$e^+e^- \rightarrow \text{hadrons}$
$30.7^{+8.3}_{-7.0} \pm 3.1$	¹⁰ CHEN	10 BELL	$e^+e^- \rightarrow \Upsilon(1S, 2S, 3S)\pi^+\pi^-$
43 ± 4	⁸ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
74 ± 4	¹¹ AUBERT	09E BABR	$e^+e^- \rightarrow \text{hadrons}$
$112 \pm 17 \pm 23$	¹² BESSON	85 CLEO	$e^+e^- \rightarrow \text{hadrons}$
110 ± 15	¹³ LOVELOCK	85 CUSB	$e^+e^- \rightarrow \text{hadrons}$

NODE=M092W

OCCUR=2

OCCUR=2

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=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) $\times 10^{-3}$		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 ± 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 ± 0.6) $\times 10^{-3}$		DESIG=17
Γ_{18} $\Upsilon(2S)\pi^+\pi^-$	(7.8 ± 1.3) $\times 10^{-3}$		DESIG=18
Γ_{19} $\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$		DESIG=19
Γ_{20} $\Upsilon(1S)K^+K^-$	(6.1 ± 1.8) $\times 10^{-4}$		DESIG=20
Γ_{21} $\eta\Upsilon_J(1D)$	(4.8 ± 1.1) $\times 10^{-3}$		DESIG=40
Γ_{22} $h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$		DESIG=26
Γ_{23} $h_b(2P)\pi^+\pi^-$	(5.7 $^{+1.7}_{-2.1}$) $\times 10^{-3}$		DESIG=27
Γ_{24} $\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	(2.5 ± 2.3) $\times 10^{-3}$		DESIG=41
Γ_{25} $\chi_{b0}(1P)\pi^+\pi^-\pi^0$	< 6.3 $\times 10^{-3}$	90%	DESIG=30
Γ_{26} $\chi_{b0}(1P)\omega$	< 3.9 $\times 10^{-3}$	90%	DESIG=31
Γ_{27} $\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	< 4.8 $\times 10^{-3}$	90%	DESIG=32
Γ_{28} $\chi_{b1}(1P)\pi^+\pi^-\pi^0$	(1.85 ± 0.33) $\times 10^{-3}$		DESIG=33
Γ_{29} $\chi_{b1}(1P)\omega$	(1.57 ± 0.30) $\times 10^{-3}$		DESIG=34
Γ_{30} $\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	(5.2 ± 1.9) $\times 10^{-4}$		DESIG=35
Γ_{31} $\chi_{b2}(1P)\pi^+\pi^-\pi^0$	(1.17 ± 0.30) $\times 10^{-3}$		DESIG=36
Γ_{32} $\chi_{b2}(1P)\omega$	(6.0 ± 2.7) $\times 10^{-4}$		DESIG=37
Γ_{33} $\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	(6 ± 4) $\times 10^{-4}$		DESIG=38
Γ_{34} $\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega$	< 3.8 $\times 10^{-5}$	90%	DESIG=39

Inclusive Decays.

NODE=M092;CLUMP=I

These decay modes are submodes of one or more of the decay modes above.

NODE=M092

Γ_{35} ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %	DESIG=12
Γ_{36} D^0 anything + c.c.	(108 ± 8) %	DESIG=13
Γ_{37} D_s anything + c.c.	(46 ± 6) %	DESIG=6
Γ_{38} J/ψ anything	(2.06 ± 0.21) %	DESIG=14
Γ_{39} B^0 anything + c.c.	(77 ± 8) %	DESIG=21
Γ_{40} B^+ anything + c.c.	(72 ± 6) %	DESIG=22

 $\Upsilon(10860)$ PARTIAL WIDTHS

NODE=M092220

 $\Gamma(e^+e^-)$ **Γ_{15}**

VALUE (keV)	DOCUMENT ID	TECN	COMMENT
0.31 ± 0.07 OUR AVERAGE	Error includes scale factor of 1.3.		
0.22 ± 0.05 ± 0.07	BESSON	85	CLEO $e^+e^- \rightarrow \text{hadrons}$
0.365 ± 0.070	LOVELOCK	85	CUSB $e^+e^- \rightarrow \text{hadrons}$

 NODE=M092W1
 NODE=M092W1

$$\Gamma(e^+e^-) \times \Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{17}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

1.09±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 $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

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
NODE=M092R50

NODE=M092R50;LINKAGE=A

NODE=M092R50;LINKAGE=B

$$\Gamma(e^+e^-) \times \Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{18}/\Gamma$$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT

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

2.58±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 $\sqrt{s} = 10.6\text{--}11.05$ GeV, including the initial-state radiation at $\Upsilon(10860)$.

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
NODE=M092R51

NODE=M092R51;LINKAGE=A

NODE=M092R51;LINKAGE=B

$$\Gamma(e^+e^-) \times \Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{15}\Gamma_{19}/\Gamma$$

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

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

$$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X)$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_3/Γ_1
0.24±0.09±0.03	10	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$	

NODE=M092R06
NODE=M092R06

$$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ
0.381±0.034 OUR AVERAGE				

NODE=M092R14
NODE=M092R14

$$0.375^{+0.021}_{-0.019} \pm 0.030$$

¹ DRUTSKOY 10 BELL $\Upsilon(5S) \rightarrow B^+ X, B^0 X$

$$0.436 \pm 0.083 \pm 0.072$$

² HUANG 07 CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$

¹ Assuming isospin conservation.

² Using measurements or limits from AQUINES 06.

NODE=M092R14;LINKAGE=DR
NODE=M092R14;LINKAGE=HU

$$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_4/Γ_1
0.74±0.15±0.08	31	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$	

NODE=M092R07
NODE=M092R07

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ
<0.197	90	¹ HUANG	07	CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$	

NODE=M092R17
NODE=M092R17

¹ Using measurements or limits from AQUINES 06.

NODE=M092R17;LINKAGE=HU

$$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT	Γ_5/Γ_1
<0.32	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$	

NODE=M092R08
NODE=M092R08

$$\Gamma(B\bar{B}\pi)/\Gamma_{\text{total}}$$

VALUE (units 10 ⁻²)	EVTs	DOCUMENT ID	TECN	COMMENT	Γ_6/Γ
0.0±1.2±0.3	0	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+, 0\pi^- X$	

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	Γ_7/Γ
7.3^{+2.3}_{-2.1} ± 0.8	38	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+, 0\pi^- X$	

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	Γ_8/Γ
1.0^{+1.4}_{-1.3} ± 0.4	5	¹ DRUTSKOY	10	BELL $\Upsilon(5S) \rightarrow B^+, 0\pi^- X$	

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	Γ_9/Γ
<0.089	90	¹ HUANG	07	CLEO $\Upsilon(5S) \rightarrow \text{hadrons}$	

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	Γ_9/Γ_1
<0.14	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow \text{hadrons}$	

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 ←

$$0.189^{+0.027}_{-0.021} \text{ OUR AVERAGE}$$

$$0.172 \pm 0.030$$

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 $e^+e^- \rightarrow D_X X$

¹Supersedes DRUTSKOY 07.

²Supersedes 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.

³Using $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

⁴Uses 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

$$\Gamma(B_s^{(*)} \bar{B}_s^{(*)}) / \Gamma(B \bar{B} X)$$

$$\Gamma_{10} / \Gamma_1$$

VALUE

DOCUMENT ID

$$0.264^{+0.052}_{-0.045} \text{ OUR EVALUATION}$$

NODE=M092R34
NODE=M092R34

→ 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

87.0 ± 1.7

^{1,2} ESEN

13

BELL

$B_s^0 \rightarrow D_s^- \pi^+$

90.5 ± 3.2 ± 0.1

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. • • •

90.1^{+3.8}_{-4.0} ± 0.2

⁴ LOUVOT

09

BELL

10.86 $e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)}$

93⁺⁷₋₉ ± 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 $N(B_s^* \bar{B}_s^0) / N(B_s^{(*)} \bar{B}_s^{(*)})$ 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.

NODE=M092R19
NODE=M092R19

NODE=M092R19;LINKAGE=ES

NODE=M092R19;LINKAGE=IL

NODE=M092R19;LINKAGE=LI

NODE=M092R19;LINKAGE=DR

$$\Gamma(B_s \bar{B}_s) / \Gamma(B_s^{(*)} \bar{B}_s^{(*)})$$

$$\Gamma_{11} / \Gamma_{10} = \Gamma_{11} / (\Gamma_{11} + \Gamma_{12} + \Gamma_{13})$$

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=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 ± 2.5 ± 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} ± 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 $N(B_s^* \bar{B}_s^0) / N(B_s^{(*)} \bar{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72 .

NODE=M092R25
NODE=M092R25

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

$$0.038^{+0.051}_{-0.005} \text{ OUR EVALUATION}$$

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 × 10⁻⁵

90

SHEN

13A

BELL

$e^+ e^- \rightarrow K^*(892)^0 \bar{K}^0$

NODE=M092R35
NODE=M092R35

$\Gamma(\eta \Upsilon_J(1D))/\Gamma_{\text{total}}$ Γ_{21}/Γ VALUE (units 10^{-3})

DOCUMENT ID

TECN

COMMENT

 $4.8 \pm 0.92 \pm 0.67$ ¹ TAMPONI 18 BELL $e^+e^- \rightarrow \Upsilon(5S) \rightarrow \eta X$ ¹ Mainly $J = 2$, assumes no continuum contribution under $\Upsilon(5S)$.NODE=M092R48
NODE=M092R48

NODE=M092R48;LINKAGE=A

 $\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{17}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $5.3 \pm 0.3 \pm 0.5$

325

¹ CHEN 08 BELL $10.87 e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$ ¹ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.NODE=M092R20
NODE=M092R20

NODE=M092R20;LINKAGE=CH

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

 $\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{19}/Γ VALUE (units 10^{-3})

EVTS

DOCUMENT ID

TECN

COMMENT

 $4.8 \pm 1.8 \pm 0.7$
 1.5 ± 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

 $\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ VALUE (units 10^{-4})

EVTS

DOCUMENT ID

TECN

COMMENT

 $6.1 \pm 1.6 \pm 1.0$
 1.4 ± 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

 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ Γ_{22}/Γ_{18}

VALUE

DOCUMENT ID

TECN

COMMENT

 $0.45 \pm 0.08 \pm 0.07$
 0.12

ADACHI

12

BELL $10.86 e^+e^- \rightarrow \text{hadrons}$ NODE=M092R31
NODE=M092R31 $\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ Γ_{23}/Γ_{18}

VALUE

DOCUMENT ID

TECN

COMMENT

 $0.77 \pm 0.08 \pm 0.22$
 0.17

ADACHI

12

BELL $10.86 e^+e^- \rightarrow \text{hadrons}$ NODE=M092R32
NODE=M092R32 $\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-)$ Γ_{22}/Γ_{23}

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 $\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{24}/Γ 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 $\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{25}/Γ

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 $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.NODE=M092R36
NODE=M092R36

NODE=M092R36;LINKAGE=A

 $\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{26}/Γ

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 $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.NODE=M092R37
NODE=M092R37

NODE=M092R37;LINKAGE=A

 $\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{27}/Γ

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 $\sigma(e^+e^- \rightarrow b\bar{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.NODE=M092R38
NODE=M092R38

NODE=M092R38;LINKAGE=A

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{28}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.85 \pm 0.23 \pm 0.23$	80	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R39
NODE=M092R39

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=M092R39;LINKAGE=A

 $\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{29}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.57 \pm 0.22 \pm 0.21$	60	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R40
NODE=M092R40

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;LINKAGE=A

 $\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{30}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.52 \pm 0.15 \pm 0.11$	24	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R41
NODE=M092R41

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;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{31}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$1.17 \pm 0.27 \pm 0.14$	29	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R42
NODE=M092R42

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;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{\text{total}}$ Γ_{32}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.60 \pm 0.23 \pm 0.15$	13	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R43
NODE=M092R43

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;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ Γ_{32}/Γ_{29}

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

 $\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma_{\text{total}}$ Γ_{33}/Γ

VALUE (units 10^{-3})	EVTs	DOCUMENT ID	TECN	COMMENT
$0.61 \pm 0.22 \pm 0.28$	16	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R45
NODE=M092R45

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;LINKAGE=A

 $\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})/\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega})$ Γ_{33}/Γ_{30}

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

 $\Gamma(\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.8 \times 10^{-5}$	90	¹ HE	14	BELL $\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

NODE=M092R47
NODE=M092R47

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 GeV/ c^2 and 10.65 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;LINKAGE=A

 $\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$0.138 \pm 0.007^{+0.023}_{-0.015}$	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_{36}/Γ
1.076$\pm$0.040$\pm$0.068	DRUTSKOY	07	BELL	$\Upsilon(5S) \rightarrow D^0 X$

NODE=M092R10
NODE=M092R10

 $\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT	Γ_{37}/Γ
0.46 $\pm$0.06 OUR AVERAGE				
0.472 $\pm$ 0.024 $\pm$ 0.072	¹ DRUTSKOY	07	BELL	$\Upsilon(5S) \rightarrow D_s X$
0.44 $\pm$ 0.09 $\pm$ 0.04	² ARTUSO	05B	CLE3	$e^+ e^- \rightarrow D_s X$

NODE=M092R02
NODE=M092R02

¹ Using $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

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.

NODE=M092R02;LINKAGE=DR

NODE=M092R02;LINKAGE=AR

 $\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT	Γ_{38}/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_{39}/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_{40}/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

DONG	20A	CP C44 083001	X.-K. Dong <i>et al.</i>		REFID=60595
MIZUK	19	JHEP 1910 220	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=60090
TAMPONI	18	EPJ C78 633	U. Tamponi <i>et al.</i>	(BELLE Collab.)	REFID=59195
YIN	18	PR D98 091102	J.H. Yin <i>et al.</i>	(BELLE Collab.)	REFID=59468
MIZUK	16	PRL 117 142001	R. Mizuk <i>et al.</i>	(BELLE Collab.)	REFID=57465
SANTEL	16	PR D93 011101	D. Santel <i>et al.</i>	(BELLE Collab.)	REFID=57121
HE	14	PRL 113 142001	X.H. He <i>et al.</i>	(BELLE Collab.)	REFID=55927
ESEN	13	PR D87 031101	S. Esen <i>et al.</i>	(BELLE Collab.)	REFID=54894
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
LI	12	PRL 108 181808	J. Li <i>et al.</i>	(BELLE Collab.)	REFID=54116
CHEN	10	PR D82 091106	K.-F. Chen <i>et al.</i>	(BELLE Collab.)	REFID=53531
DRUTSKOY	10	PR D81 112003	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=53358
AUBERT	09E	PRL 102 012001	B. Aubert <i>et al.</i>	(BABAR Collab.)	REFID=52661
LOUVOT	09	PRL 102 021801	R. Louvot <i>et al.</i>	(BELLE Collab.)	REFID=52646
CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)	REFID=52153
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=51621
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)	REFID=51852
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)	REFID=51624
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)	REFID=51106
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)	REFID=50995
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)	REFID=50992
BESSION	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

$\Upsilon(11020)$

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

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 ± 0.030 OUR AVERAGE	
$0.095 \pm 0.03 \pm 0.035$	BESSON 85 CLEO $e^+e^- \rightarrow \text{hadrons}$
0.156 ± 0.040	LOVELOCK 85 CUSB $e^+e^- \rightarrow \text{hadrons}$

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 ± 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 ± 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

$$\Gamma(\chi_{bJ}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_5/\Gamma$$

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

$$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_6/\Gamma$$

VALUE DOCUMENT ID TECN COMMENT

seen YIN 18 BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M093R01
NODE=M093R01

$$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$$

$$\Gamma_7/\Gamma$$

VALUE DOCUMENT ID TECN COMMENT

seen YIN 18 BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M093R02
NODE=M093R02

$$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)$$

$$\Gamma_7/\Gamma_6$$

VALUE DOCUMENT ID TECN COMMENT

0.4±0.2 YIN 18 BELL $e^+e^- \rightarrow \text{hadrons}$

NODE=M093R03
NODE=M093R03

$\Upsilon(11020)$ REFERENCES

NODE=M093

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.)

REFID=60595
REFID=60090
REFID=59468
REFID=57465
REFID=57121
REFID=52661
REFID=22368
REFID=22369